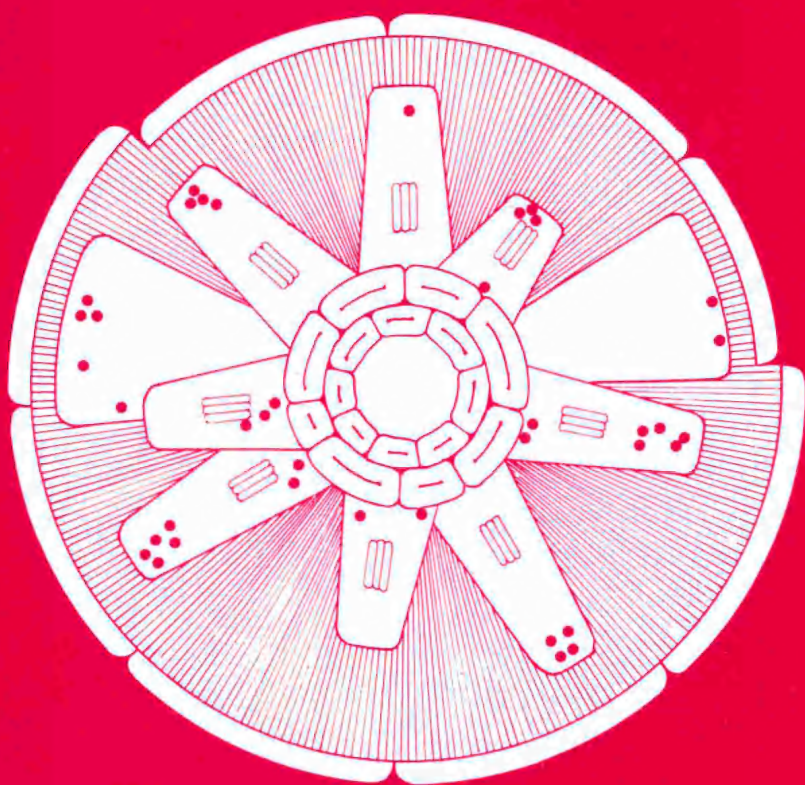


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A Journal of Plant Systematics



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**A NEW SPECIES OF *BULBOPHYLLUM* THOUARS SECTION
MICROMONANTHE (ORCHIDACEAE) FROM NORTH-
EASTERN QUEENSLAND**

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Summary

Bulbophyllum wolfei B. Gray & D. Jones, a new species of *Bulbophyllum* Thouars section *Micromonante* from north-eastern Queensland is described and illustrated.

Bulbophyllum wolfei B. Gray & D. Jones **sp. nov.** affinis *B. bowkettiae* Bailey sed rhizomatis angustioribus, pseudobulbis minoribus, foliis valde crassioribus, floribus minoribus et plus nutantibus, pedicellis tenuissimis, labello minore lobis lateralibus paucis productis. **Typus:** Queensland. COOK DISTRICT: State Forest Reserve 144, Parish of Spurgeon, Wren Logging Area, 16°11'S, 145°05'E, 940 m, 22 August 1984, *B. Gray* 3529 (holo: QRS; iso: BRI, NSW, MEL).

Plant epiphytic. Rhizomes creeping, much branched, spreading; c. 1.5 mm diameter, adhering closely to the substrate, when young covered by pale grey-brown scarious bracts, becoming naked and furrowed with age; roots wiry, c. 0.2 mm diameter, arising from rhizome nodes; pseudobulbs 10-60 mm apart, 4-9 mm × 3-5 mm, more or less ovoid, green, faintly sulcate, appressed to the rhizome. Leaf lamina 9-25 mm × 3-6 mm, linear-elliptic to linear-oblong, thick and fleshy, shallowly V-shaped in cross section, more or less sessile. Flowers 5-8 mm diameter, solitary at nodes on bracteate, strongly nodding pedicels c. 2 mm long, cream with prominent red to maroon longitudinal stripes; dorsal sepal c. 6.5 mm × 2 mm, linear-elliptic to linear-ovate, cucullate over column, apex cymbiform; lateral sepals c. 6.5 mm × 2.5 mm, triangular-lanceolate, asymmetric, widely divergent, apex cymbiform; petals c. 2 mm × 1.2 mm, asymmetrically ovate, whitish, apex truncate to retuse; labellum c. 4.8 mm × 2 mm, thick and fleshy, maroon, erect in proximal third then curved forwards, dorsal surface smooth, ventral surface verrucose to papillose, obscurely three-lobed, obtuse, apex obtuse; column c. 1.2 mm long; stelia c. 0.5 mm long, linear, slightly curved, subulate; column foot c. 1.2 mm, slightly curved forward; anther cap c. 1 mm × 0.8 mm, with a beak-like rostrum. Capsule not seen.

Additional specimen examined: Windsor Tableland, Feb 1990, *Jones 4353 & Clements* (CBG).

Distribution and habitat: At present this species is known only from the Mt Windsor Tableland where it grows on the upper branches of trees in highland rainforest above 900 m altitude.

Flowering period: Sporadically from April to September but flowering has occurred as early as January under glasshouse conditions.

Notes: *B. wolfei* is closely related to *B. bowkettiae*, but is readily distinguished by the much thicker leaves and the smaller, strongly nodding flowers. Plants form larger, sparser clumps than those in *B. bowkettiae*, have very slender rhizomes and smaller pseudobulbs relatively distinct on the rhizomes. *B. wolfei* is at present known from only a few plants but because of its superficial resemblance to *B. bowkettiae* it is probable that it has often been mistaken for that species, however, all specimens of *B. bowkettiae* examined appear to have been correctly identified. *B. bowkettiae* is a much more common species occurring from the McIlwraith Range south to the Tully River.

Conservation status: 2RC according to the criteria of Briggs and Leigh (1988).

Etymology: It gives us great pleasure to name this orchid in honour of Mr T.J. (Tom) Wolfe, of Atherton, Queensland. As well as being a great companion in the bush he has

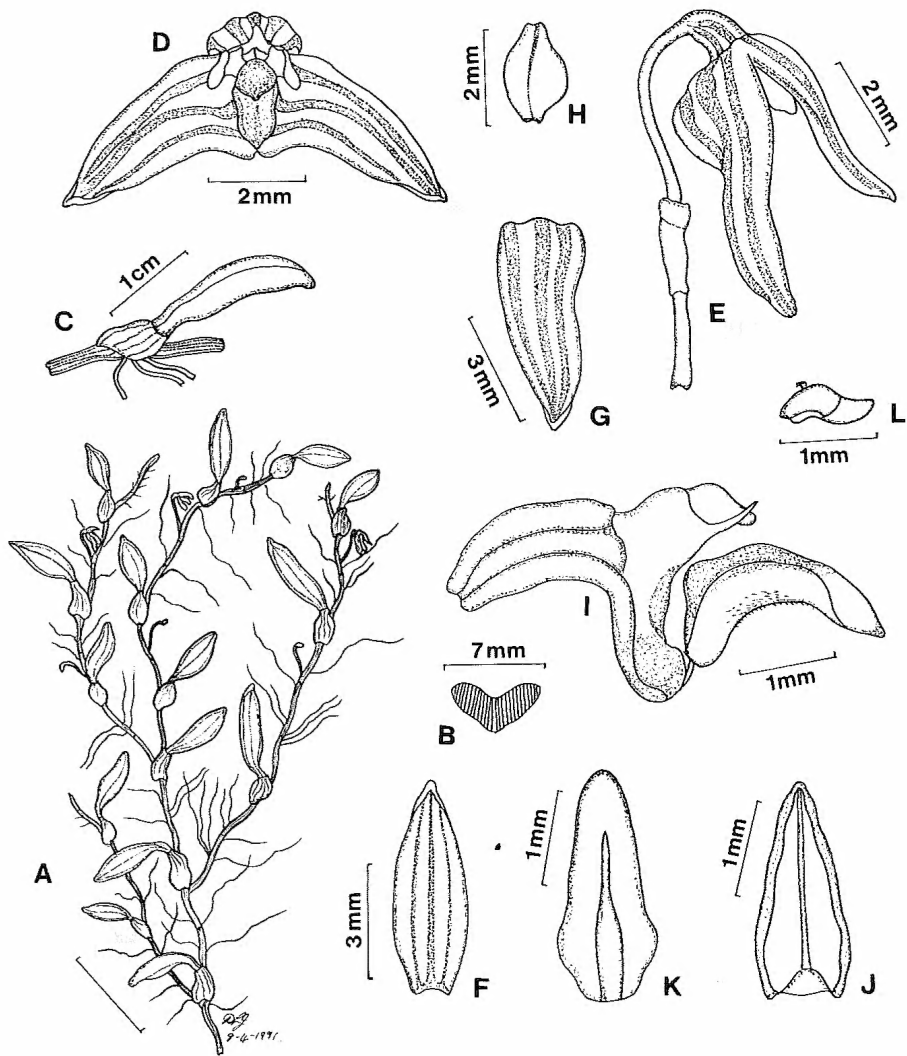


Fig. 1. *Bulbophyllum wolfei*: A. habit. B. section through leaf. C. section of rhizome, pseudobulb and leaf. D. flower from front. E. flower from side. F. dorsal sepal. G. lateral sepal. H. petal. I. column and labellum from side. J. labellum from below. K. labellum from above. L. anther from side. All from Jones 4353.

been of significant help in our orchid research.

Acknowledgements

The authors wish to thank Barbara Jones for processing the manuscript.

Reference

- BRIGGS, J.D. & LEIGH, J.H. (1988). Rare or Threatened Australian Plants. 1988 Revised Edition. Australian National Parks and Wildlife Service Special Publication No. 14. Canberra: Australian National Parks and Wildlife Service.

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A TAXONOMIC REVISION OF *SARCOLOBUS* R. BR. (ASCLEPIADACEAE: MARSDENIEAE) IN AUSTRALIA AND PAPUASIA

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Summary

The genus *Sarcolobus* R. Br. is revised for Australia and Papuaia (Irian Jaya, Papua New Guinea and Solomon Islands). *Astelma* Schltr. and *Papuastelma* Bullock are considered congeneric. Three species occur in Australia, namely *S. ritae* sp. nov., *S. vittatus* sp. nov. and *S. hullsii* comb. nov. (*Marsdenia hullsii* F. Muell. ex Benth.). Nine species occur in Papuaia including *S. porcatus* sp. nov., *S. spathulatus* sp. nov., *S. vittatus* sp. nov., *S. kaniensis* comb. nov. (*Gymnema kaniense* Schltr.), *S. secamonoides* comb. nov. (*Astelma secamonoides* Schltr.) and *S. brachystephanus* comb. nov. (*Marsdenia brachystephana* Schltr.). Separate keys to the Australian and Papuaian taxa are given.

Introduction

A monograph of *Sarcolobus* R. Br. was given by Rintz (1980) who recognised four species from Asia, Malesia and Melanesia. All of these species occur in littoral or mangrove habitats. Examination of a wide range of material of Asclepiadaceae from Australia and Papuaia (Irian Jaya, Papua New Guinea and Solomon Islands) has revealed the existence of additional taxa of *Sarcolobus* from these regions. The genus has diversified considerably in Australia and New Guinea, as the species additional to those described by Rintz, are mainly plants of woodlands or montane rainforests. In most instances the specimens concerned from Papuaia that I examined, were filed in herbaria as 'Asclepiadaceae indet.', 'Apocynaceae indet.' or under various other genera. Hence it is unlikely that these specimens were examined by Rintz, particularly as large numbers of *Sarcolobus* specimens of the species that he did cover were also present as 'Asclepiadaceae indet.' in a number of herbaria such as A and L where he examined some material.

Generic delimitation in the group of genera closely related to *Sarcolobus* has not previously been satisfactorily resolved. In the Australian and Papuaian region, these genera include *Marsdenia* R. Br., *Gymnema* R. Br., *Stephanotis* Thouars, *Tylophora* R. Br., *Gongronema* Decne., *Bidaria* Endl., *Leichardtia* R. Br. and *Gunnessia* P. Forster (Forster 1990b). Rintz (1980) also discussed *Dorystephania* Warb. and *Pentasachme* Wallich in relation to *Sarcolobus*. I am not familiar with material of the first of these but *Pentasachme* is not related to *Sarcolobus* and belongs to the Stapeliaceae as defined by Bruyns and Forster (1991).

Several of these genera, namely *Marsdenia*, *Gymnema*, *Tylophora* and *Leichardtia*, were defined by Brown (1810a, b, 1811) on a small number of species and have been added to rather haphazardly by a number of authors, none of whom has attempted to critically examine the overall make-up of the group in terms of the many more species now known. My own studies have concentrated on species from Australia and Papuaia and to a lesser extent Melanesia, and I have also examined a number of critical taxa from Asia such as the lectotype species of *Marsdenia* (*M. tinctoria* R. Br.), and the type species of *Gongronema* (*G. nepalense* Decne.) and *Bidaria* (*Asclepias tingens* Roxb.). It appears that generic delimitation among these genera has been mainly based on the development of both corolline and staminal coronas and to a lesser extent on corolla form and pollinarium structure. These 'coronas' are fleshy outgrowths that take the form of lobes adnate to the staminal column and may be quite well developed ("staminal corona"), or may take the form of raised ridges with or without hairs and with or without terminal lobes in the corolla throat ("corolline corona").

The earliest two genera recognised, *Marsdenia* and *Gymnema*, have been traditionally distinguished by the presence in the former of a staminal corona and the lack of a corolline corona, and in the latter by the lack of a staminal corona and the presence of a corolline corona. The varying development of these types of coronas may be construed as being selection in relation to co-evolution with pollinators. However, their functional significance is obscure at this point of time. From examination of approximately

75 taxa currently referred to the genera listed above, it is obvious that the degree of development of these coronas cannot be satisfactorily utilised in generic delimitation, but is very useful in defining species and infraspecific taxa. Generic delimitation in *Marsdenia*, including the proposed congeneric *Gymnema*, *Bidaria* and *Leichardtia*, will be discussed in more detail in the revision of the Australian taxa of that group which will be published once the problem of priority of *Stephanotis* over *Marsdenia* is resolved (Forster 1990a). In this paper I will deal only with *Sarclobus* in any detail and outline how this genus differs from the others in the group mentioned above. At this stage it suffices to state that there is a complete gradation in development of these coronas from those taxa that do not have any coronal development to those that have a well-developed staminal corona, or a well-developed corolline corona or both types of corona. This is particularly noticeable in closely allied taxa such as *Gymnema brevifolium* Benth., *G. trinerve* R. Br., *Marsdenia suaveolens* R. Br. and several recognizable but unnamed taxa. This wide variation in the development of the coronas was previously noted by Rintz (1980) for *Sarclobus* in his treatment of *S. globosus*. Hence it should be noted that within my concept of *Sarclobus* there are species that may have either (1) no staminal or corolline coronas, (2) a staminal corona only, (3) a corolline corona only, or (4) both staminal and corolline coronas.

The main distinguishing characters for *Sarclobus* are the slight to strongly papillate style-head, the narrowly-oblong corpuscles that stand upright away from the anthers and are of similar length or longer than the pollinia, and the geniculate caudicles of the pollinaria. This combination of characters does not occur in related genera such as *Gongronema* (in using the type species *G. nepalense* at least as an example), *Marsdenia* s. lat. (including *Stephanotis*, *Gymnema*, *Bidaria* and *Leichardtia*), *Tylophora* or *Gunnessia* P. Forster. The distinguishing features of these genera are compared in Table 1. Rintz (1980) also considered that the shape of the fruit and the presence or absence of a coma on the seeds were of importance in defining *Sarclobus*. Fruits are still unknown for some of the new taxa from Papuasias described in this paper, so I cannot comment on this character. The presence or absence of a coma on the seeds between different species, also occurs in the unrelated *Cynanchum* L. (Forster 1991). In the species of *Sarclobus* and *Cynanchum* where a coma is absent, the plants are generally coastal or aquatic inhabitants and the seeds have outer seed coats with well developed lateral margins. It may be inferred that such seeds are adapted to water dispersal but field observations are required to confirm this.

There is little to separate *Gongronema* from *Marsdenia* s. lat. (Table 1) so the former may be better included in the latter. The genera compared in Table 1 may be separated using the following key.

- | | |
|--|-------------------|
| 1. Corolla depressed-globose; staminal corona comprising a tube completely enclosing the staminal column | Gunnessia |
| Corolla rotate, campanulate, salverform or urceolate; staminal corona absent or of 5 free lobes | 2 |
| 2. Style-head papillate; corpuscles 5 or more times as long as wide | Sarclobus |
| Style-head smooth; corpuscles less than 5 times as long as wide | 3 |
| 3. Caudicles geniculate | Gongronema |
| Caudicles not geniculate | 4 |
| 4. Pollinia oblong to ellipsoid, held erect to incurved | Marsdenia |
| Pollinia globose to subglobose, held horizontal to semi-erect | Tylophora |

While several of the species enumerated in this account of *Sarclobus* were previously undescribed, four were described in other genera apart from *Sarclobus*. The Australian and New Guinean species, *S. hullsii* (F. Muell. ex Benth.) P. Forster was described as a *Marsdenia* species by Bentham (1869), the New Guinean *S. brachystephanus* (Schltr.) P. Forster under *Marsdenia* by Schlechter (1905), the New Guinean *S. kaniensis* (Schltr.) P. Forster under *Gymnema* by Schlechter (1914) and the New Guinean species *S. secamonoides* (Schltr.) P. Forster was described as the only species of the genus *Astelma* by Schlechter (1914). As *Astelma* Schltr. was a later homonym for *Astelma* R.

Table 1. Comparison of some diagnostic floral characters of *Sarcolobus*, *Marsdenia*, *Tylophora*, *Gunnessia* and *Gongronema*

Character	<i>Sarcolobus</i>	<i>Marsdenia</i>	<i>Tylophora</i>	<i>Gunnessia</i>	<i>Gongronema</i>
corolla depressed-globose	—	—	—	+	—
corolla rotate or campanulate	+	+	+	—	+
corolla salverform or urceolate	—	+	—	—	—
staminal corona comprising a tube around staminal column	—	—	—	+	—
staminal corona comprising 5 free & entire lobes fused to base of staminal column	+	+	+	—	+
gynostegium capitate	+	—	+	—	+
corpusculum narrow-oblong, 5 or more times longer than wide	+	—	—	—	—
corpusculum apex held erect and away from the style-head	+	—	—	—	—
pollinia globose to subglobose	+	—	+	+	—
pollinia oblong to ellipsoid	—	+	—	—	+
pollinia erect to incurved	—	+	—	—	+
pollinia horizontal to semi-erect	+	—	+	+	—
caudicles geniculate	+	—	—	+	—

Br. (Asteraceae), Bullock (1964) substituted the name *Papuastelma* and made the combination *P. secamonoides* (Schltr.) Bullock for the species concerned.

In publishing *Astelma*, Schlechter (1914) compared his single species, *A. secamonoides*, to species of *Gymnema*, primarily on its lack of a staminal corona. Schlechter did not comment on the distinctive narrow-oblong corpusculum, nor does his figure show the geniculate nature of the caudicles. *A. secamonoides* cannot be generically separated from the species recognised in *Sarcolobus* either by Rintz (1980) or in the present paper. Hence *Astelma* Schltr. and consequently *Papuastelma* Bullock are placed in the synonymy of the earlier *Sarcolobus* here.

Taxonomic Treatment

Sarcolobus R. Br., Asclepiad. 34 (1810). **Type:** *S. banksii* J.A. Schultes

R. Br., Mem. Wern. Soc. Nat. Hist. 1: 34 (1811); Wallich, Pl. As. Rar. 12: 566, t. 4 & 5 (1818); Schultes, Syst. Veg. 6: 58 (1820); Wight, Contrib. Bot. India 47 (1834); Schltr., Bot. Jahrb. Syst. 50: 159 (1914); Rintz, Blumea 26: 65–79 (1980).

Astelma Schltr., Bot. Jahrb. Syst. 50: 139 (1914); *Papuastelma* Bullock, Kew Bull. 19: 202 (1964), non *Astelma* R. Br. **Type:** *A. secamonoides* Schltr.

Perennial lianes or subshrubs usually with white latex. Stems slender or becoming corky and lenticellate with age, twining or trailing. Roots fibrous. Leaves opposite, flattened in cross-section, coriaceous or herbaceous, margins entire or lobed, glabrous or with indumentum of simple, multicelled trichomes, extrafloral nectaries present at lamina base, petiolate with small stipular structures at base. Cymes appearing at nodes between the pair of leaves, 1–many-flowered. Sepals 5, distinct, usually with glands at base of lobes. Corolla deeply 5-lobed, rotate to campanulate; lobes not contorted in bud. Corolline corona, if present, consisting of 5 ridges in the corolla throat terminating in lobes at the top of the corolla tube. Staminal corona if present, consisting of 5 lobes adnate to staminal column. Stamens inserted at corolla-tube base, connate; anthers each with an incurved terminal appendage. Pollinaria each with 2 pollinia; pollinia semi-erect to horizontal, 2 in each anther theca, globose, oblong or ellipsoid; corpusculum narrow-

oblong, more than 5 times as long as wide, the upper portion usually vertical and standing free from the anthers; caudicles flattened, geniculate. Gynostegium conical to pyramidal; style head enclosed by stamens, papillate, with 5 distinct ridges running down towards corpuscula; ovaries free except for bases and tips, glabrous. Follicles fusiform to ovoid, smooth or somewhat roughened; triangular to semi-quadrate in cross-section, solitary or rarely paired. Seeds flat, ovate or oblong, brown, comose at germinating end only or lacking a coma.

A genus of 13 species in India, Malesia (including Papuasias), Melanesia and Australia. Three species in Australia and eight in Papuasias.

Note: Indumentum cover is as defined by Hewson (1988), except that the term 'scattered' is used instead of 'isolated'.

Key to the species of *Sarcolobus* in Australia

1. Leaf lamina elliptic-ovate; inner corolla surface papillate; pollinia globose 1. *S. ritae*
 Leaf lamina lanceolate to ovate; inner corolla surface glabrous; pollinia oblong-globose 2
2. Foliage with sparse to dense indumentum; flowers 9–14 mm diameter 2. *S. hullsii*
 Foliage glabrous; flowers 2.6–3 mm diameter 3. *S. vittatus*
1. *Sarcolobus ritae* P. Forster sp. nov. ad *S. hullsium* (F. Muell. ex Benth.) P. Forster affinis, a qua floribus 13–15 mm diam., corolla pagina adaxiali loborum papillata, tubo corollae c. 6 mm diam., columna staminali 1.75–2 mm diam., et polliniis globosis, 0.2–0.28 mm longis differt. **Typus:** Australia, Northern Territory: East Coast road, Murganella area, 11°40'S, 133°08'E, 9 February 1984, D.L. Jones 1356 (holo: DNA!).

Liane, latex white. Stems cylindrical, up to 2 mm diameter; internodes up to 25 cm long. Leaves petiolate; lamina elliptic-ovate, up to 12 cm long and 9 cm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 2 or 3 from the base of the midrib, tertiary venation obscure, with sparse indumentum; tip acuminate; base strongly cordate; petiole grooved along top, up to 5 cm long and c. 1 mm wide; extrafloral nectaries 7–14 at base of lamina, occasionally 1 or 2 further up lamina midrib. Cyme comprising 1 or 2 umbelliform fascicles; peduncle up to 20 mm long and 1 mm diameter, with sparse indumentum; bracts ovate c. 1 mm long and 1 mm wide, with sparse indumentum. Flower rotate, strongly scented, c. 4 mm long, 13–15 mm diameter; pedicels 5–12 mm long, c. 1 mm diameter, with scattered to sparse indumentum. Sepals ovate, c. 3 mm long and 2 mm wide, externally with sparse indumentum; base of each sinus with 2 or 3 glands. Corolla black-red or brown; tube c. 1.5 mm long and 6 mm diameter; lobes ovate, reflexed, 5–6 mm long, 4–5 mm wide, with sparse indumentum on edges, upper surface papillate. Corolline corona absent. Staminal corona consisting of 5 lobes adnate to base of staminal column and sunken in corolla throat, c. 1 mm long and 2.5 mm diameter, brown or purplish; each lobe depressed-ovoid, c. 1 mm long and 1 mm wide. Staminal column c. 1 mm long and 2 mm wide; anther appendages ovate, c. 0.5 mm long and 0.5 mm wide; slit between anther wings c. 0.25 mm long, not extending below anthers. Style-head conical, 0.75–1 mm wide. Pollinarium c. 0.3 mm long, 0.5–0.6 mm wide; pollinia globose, 0.22–0.28 mm long, 0.12–0.14 mm wide; corpusculum 0.24–0.25 mm long, 0.05–0.06 mm wide; caudicles geniculate in middle, 0.25–0.3 mm long, 0.02–0.03 mm wide. Follicles and seed not seen. **Figs 1 & 2.**

Specimens examined: Known only from the type collection.

Distribution and habitat: Endemic in the north-eastern end of the Northern Territory (Map 1) where it occurs in seasonally wet open forest communities.

Phenology: Probably flowering from December to March and fruiting several months later.

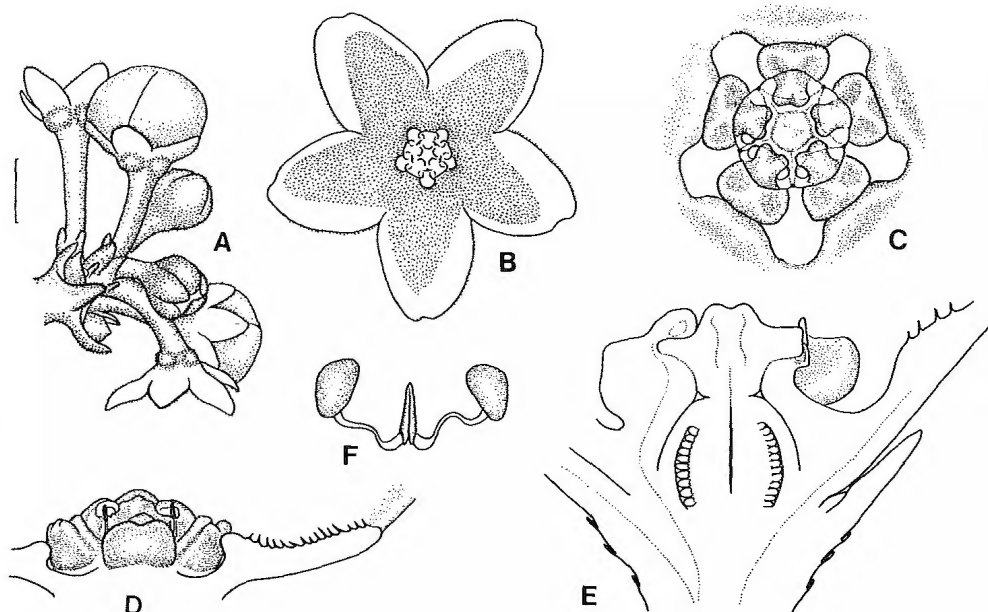


Fig. 2. *Sarcolobus ritae*: A. cyme $\times 2$. B. face view of flower showing papillate area $\times 2$. C. face view of staminal corona and staminal column $\times 8$. D. lateral view of staminal corona and staminal column, and cross-section of corolla showing papillate nature of upper surface $\times 8$. E. lateral cross-section of flower $\times 12$. F. pollinarium $\times 30$. (All from Jones 1356, DNA). Del. P.V. Bruyns.

Notes: This species is very closely allied to *S. hullsii* and both species appear to be more closely related to each other than to the other taxa enumerated by Rintz (1980) or to others described in this paper. *S. ritae* differs from *S. hullsii* in the papillate inner corolla surface, the flowers 13–15 mm in diameter, the corolla tube c. 6 mm in diameter, the staminal column 1.75–2 mm in diameter and the globose pollinia 0.2–0.28 mm in length. Both species appear to be sympatric in the Murganella area.

Conservation status: A coding of 1K (cf. Briggs & Leigh 1988) is appropriate at this stage as further field work is required to ascertain the distribution of this plant in Arnhem Land.

Etymology: Named for Mrs Rita Tingey of Palmerston, Northern Territory, who contributed a number of most useful specimens of asclepiads from the Palmerston/Darwin area in the early days of my research on the family.

2. *Sarcolobus hullsii* (F. Muell. ex Benth.) P. Forster **comb. nov.** *Marsdenia hullsii* F. Muell. ex Benth., Fl. austral. 4: 338 (1869). **Type:** Australia, Northern Territory: Adams Bay, [undated] *Hulls* (holo: K *n.v.*, photo at BRI!; iso: BRI(AQ 333106!), MEL(MEL 113416!)).

Tylophora sp., Jones & Gray, Climbing Pl. Austral. 352, 356 (1988).

Liane, latex white. Stems cylindrical, up to 2 mm diameter; internodes up to 10 cm long, with sparse to dense indumentum in two ridges on opposite sides. Leaves petiolate; lamina lanceolate to ovate, up to 9 cm long and 4 cm wide, discolorous; above green, venation obscure, glabrous; below pale green, secondary veins 4–9 per side of midrib, tertiary venation obscure, with sparse to dense indumentum; tip acuminate; base strongly cordate to truncate; petiole grooved along top, to 2 cm long and c. 1 mm wide, with sparse indumentum; extrafloral nectaries 2–7 at lamina base. Cymes umbelliform to somewhat racemiform, up to 2.5 cm long, 1–many-flowered; peduncle up to 1 cm long, c. 1 mm diameter, with scattered to sparse indumentum; bracts triangular to lanceolate, 0.5–1 mm long, 0.5–0.6 mm wide. Flower rotate, 3–5 mm long, 8–13 mm diameter; pedicels 5–10 mm long, 0.5–1 mm diameter, with scattered to sparse indumentum. Sepals lanceolate to ovate, 2–3 mm long, 1.5–2 mm wide, externally with sparse

indumentum; base of each sinus with 1–3 glands. Corolla mauve to brown inside, green outside; tube 0.75–2 mm long, 2–5 mm diameter; lobes lanceolate to ovate, 3–5 mm long, 3.5–4 mm wide, apex notched, glabrous. Corolline corona absent. Staminal corona cupular and recessed in corolla tube, with 5 separate lobes adnate to staminal column below anthers, 0.5–1 mm long, 1.8–3 mm diameter; each lobe flattened-truncate, 0.5–1 mm long, 0.75–1.1 mm wide. Staminal column 0.8–1 mm long, 1.5–2 mm diameter; anther appendages acute to obtuse, 0.5–0.75 mm long, 0.5–0.7 mm wide; slit between anther wings 0.1–0.2 mm long, not extending below anthers. Style-head conical, flattened, c. 0.75 mm long, 0.75–1.5 mm diameter. Pollinarium c. 0.4 mm long and 0.5 mm wide; pollinia held semi-horizontal to erect, oblong-globose, 0.3–0.5 mm long, 0.15–0.27 mm wide; corpusculum oblong, 0.17–0.25 mm long, 0.06–0.07 mm wide; caudicle geniculate in middle, 0.15–0.27 mm long, 0.02–0.05 mm wide. Ovaries c. 1.5 mm long and 1.5 mm wide. Follicles fusiform-ovoid, 10–13 cm long, 1.5–2 cm wide. Seed ovate, c. 9 mm long and 4 mm wide; coma 25–35 mm long. **Figs 3 & 4.**

Specimens examined: Papua New Guinea, CENTRAL PROVINCE: Eastern footslopes of Tovobada Hills, 12 miles [20 km] N of Port Moresby, May 1965, *Heyligers* 1260 (CANB,L). Australia, Northern Territory, Workshop road, Murganella, 11°30'S, 132°56'E, Feb 1984, *Jones* 1353 (BRI,DNA); Tarracumbi Ck, Melville Is, 11°36'S, 130°43'E, Nov 1989, *Forster* 6095 & *Russell-Smith* (BRI,DNA,QRS); Chingwah Terrace, Palmerston, 12°29'S, 130°58'E, Dec 1987, *Cox* [AQ 459719] (BRI); Holmes Jungle, 12°24'S, 130°56'E, Jan 1988, *Stobo* [AQ 459698] (BRI); 10 miles

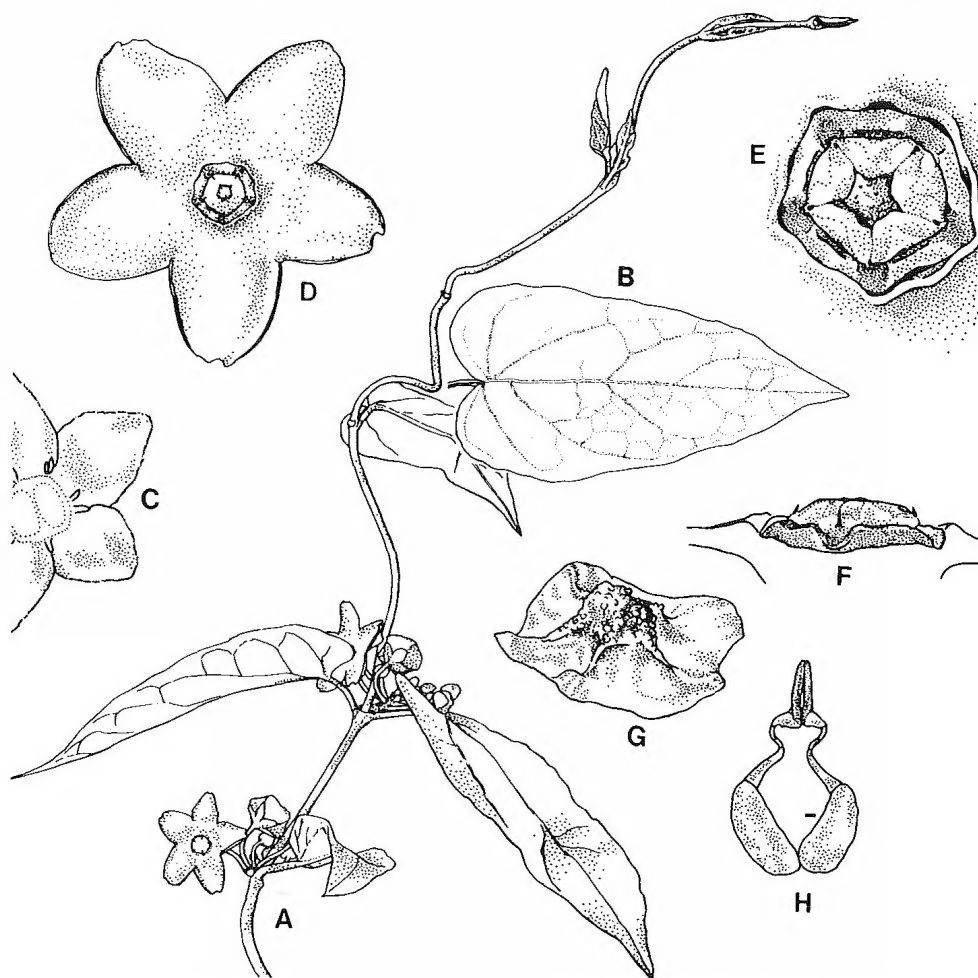


Fig. 3. *Sarcolobus hullsii*: A. habit of flowering shoot $\times 1$. B. leaf $\times 1$. C. face view of calyx showing glands and position of ovaries (stippled) $\times 6$. D. face view of flower $\times 3$. E. face view of staminal corona and staminal column $\times 9$. F. lateral view of staminal corona and staminal column $\times 9$. G. oblique view of style-head, showing 5 ridges and papillate nature $\times 18$. H. pollinarium $\times 37$. (All from Stobo s.n., BRI). Del. K. Harold.

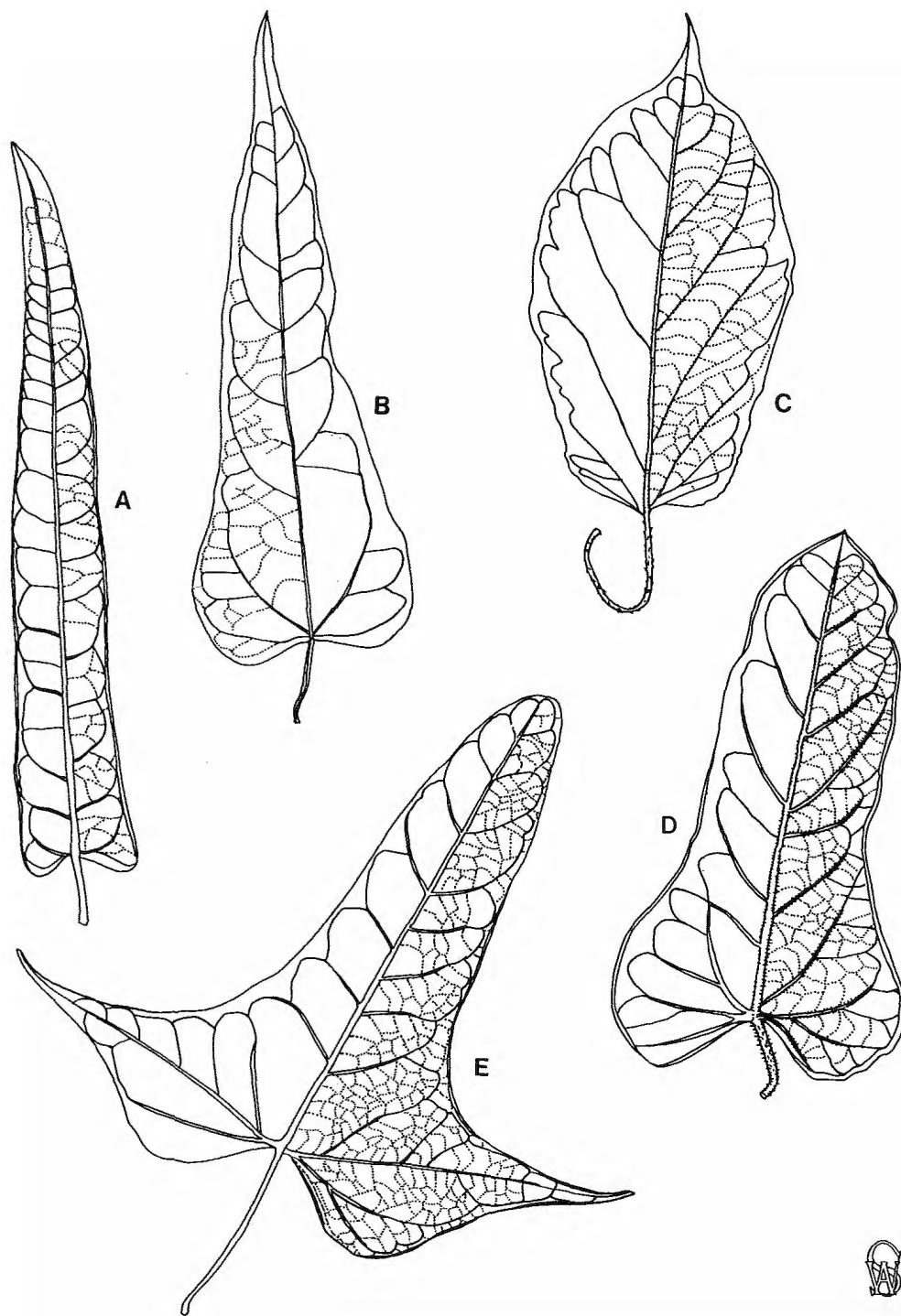


Fig. 4. *Sarcolobus hullsii*: Variation in leaf shape, all $\times 1$. A. Forster 4410. B. Forster 4501. C. Forster 4573. D. Forster 5474. E. Forster 4563. Del. W.A. Smith.

[16 km] NW Humpty Doo, Nov 1971, *McKean* B144 (DNA); 7 km N of Cannon Hill, 12°17'S, 132°52'E, Jan 1984, *Russell-Smith* 956 (DNA); 1 mile [1.7 km] SW of Cannon Hill, Feb 1973, *Martensz & Schodde* AE641 (CANB,DNA); 23 km E Adelaide River Bridge, Arnhem Highway, 12°48'S, 132°32'E, Jan 1984, *Russell-Smith* 940 (DNA); Little Nourlangie Rock, 12°52'S, 132°48'E, Jan 1979, *Dunlop* 5199 (CANB,DNA); Ibangu, creek S end of Ja Ja Massif, 12°33'S, 132°55'E, Feb 1984, *Russell-Smith* 1116 (CANB,DNA). Queensland, COOK DISTRICT: Badu Is, Torres Strait, 10°07'S, 142°07'E, Dec 1976, *Cameron* 2677 (QRS); Kubin Village, Banks (Moa) Is, Torres Strait, 10°10'S, 142°15'E, Aug 1975, *Cameron* 2450 (QRS); 92 km from Bamaga on road south, 11°28'S, 142°27'E, Jun 1988, *Forster* 4488 & *Tucker* (BRI); Bertie Ck, 1 km N of Dulhunty River, 11°50'S, 142°30'E, Jun 1988, *Forster* 4501 & *Tucker* (BRI); Head of Hann Creek, 12°28'S, 142°55'E, Jun 1988, *Forster* 4538 (BRI); ditto, Jun 1989, *Forster* 5474 (BRI); Head of Hann Creek, 46.5 km from Moreton Telegraph Station, 12°29'S, 142°58'E, Jun 1988, *Forster* 4563 (BRI); beach south of Kennedy Hill, 12°29'S, 143°16'E, Jun 1989, *Forster* 5374 (BRI); 60.5 km from Moreton Telegraph Station on Carron Valley road, 12°30'S, 143°05'E, Jun 1988, *Forster* 4573 & *Kenning* (BRI); 41.5 km past Maloney's Springs, 12°30'S, 143°14'E, Jun 1989, *Forster* 5367 (BRI); c. 2 km upstream of Brown Creek Crossing, Iron Range road, 12°46'S, 143°07'E, Apr 1988, *Forster* 4170 & *Liddle* (BRI); 2.6 km past Garraway Creek Crossing, Iron Range road, 12°44'S, 143°11'E, Apr 1988, *Forster* 4184 & *Liddle* (BRI).

Distribution and habitat: This species occurs in southern Papua New Guinea, the northern portion of the Northern Territory and far north Queensland (Map 2) where it grows in open eucalypt forest, woodlands and heaths on sandstone derived soils.

Phenology: Probably flowering from December to March and fruiting several months later.

Notes: Few species of Asclepiadaceae grow in heathland communities in Australia or elsewhere. Vegetative material of *S. hullsii* is superficially similar to that of both *Gunnessia pepo* P. Forster and *Cynanchum leptolepis* (Benth.) Domin, however these species grow in deciduous notophyll vine forest and have more glabrous leaves. One collection (*Forster* 4563 in Figure 4) is notable in the leaves being strongly trilobed which is not only unusual for this species but for Asclepiadaceae in general and parallels the lobing found in some species of *Tweedia* (Rua 1989) or *Ceropegia* (P.V. Bruyns, pers. comm. 1990).

Conservation status: Despite the lack of earlier collections from north Queensland, this is a most common species and is not rare or endangered in any way in Australia.

Ethnobotanical use: The ripe pods of this species may be eaten raw or after cooking by the Gunwing-gu dialect clan in Kakadu National Park, Northern Territory who refer to the species as "anjilat" (Russell-Smith 1985).

3. *Sarcolobus vittatus* P. Forster sp. nov. ad *S. brachystephanum* (Schltr.) P. Forster affinis a qua lobis corollae lanceolato-ovatis, 1.8–2 mm longis, corona corollina lobi parvi terminalibus carenti, et corona staminali nulla, differt. **Typus:** Australia, Queensland, COOK DISTRICT: Unigan Nature Reserve, Weipa, 12°37'S, 141°54'E, 4 March 1990, *P.I. Forster* 6506 & *M.R. O'Reilly* (holo: BRI!; iso: DNA!, L!, QRS!).

Liane, latex white. Stems cylindrical, up to 1 mm diameter; internodes up to 9 cm long, glabrous or with extremely scattered indumentum. Leaves petiolate; lamina lanceolate-ovate, up to 8 cm long and 3.5 cm wide, discolourous; above green, venation obscure, glabrous; below pale green, secondary veins 4 per side of midrib, tertiary venation reticulate, glabrous; tip acute to acuminate; base subcordate; petiole grooved along top, up to 1 cm long and c. 1 mm wide, with scattered to sparse indumentum; extrafloral nectaries 6–9 at base of lamina. Cyme umbelliform to somewhat racemiform, up to 15 mm long; peduncle up to 6 mm long, 1.8–2 mm diameter, with sparse indumentum; bracts triangular-ovate, c. 0.5 mm long, 0.3–0.5 mm wide, with sparse to scattered indumentum. Flower campanulate to urceolate, 2.5–2.8 mm long, 2.6–3 mm diameter; pedicels 1.5–5 mm long, 0.5–1 mm diameter with scattered to sparse indumentum. Sepals ovate, 1.1–1.5 mm long, 1–1.1 mm wide, ciliate, externally with scattered indumentum; base of each sinus with 1 gland. Corolla cream to greenish-yellow; tube 1–1.2 mm long, 2–3 mm diameter; lobes ovate, 1.5–2 mm long and 1.3–1.5 mm wide, glabrous, internally with a pale brown longitudinal stripe in middle. Corolline corona comprising 5 small rounded swellings just below the tube top, glabrous. Staminal corona absent. Staminal column 1.3–2 mm long, 1–1.5 mm diameter; anther appendages truncate, 0.1–0.2 mm long and c. 0.1 mm wide; slit between anther wings 0.1–0.2 mm long, not extending below anthers. Style-head c. 0.6 mm diameter, top slightly raised above anthers. Ovaries 0.6–0.7 mm long, 0.7–0.8 mm wide. Pollinarium 0.25–0.32 mm long, 0.35–0.5 mm wide; pollinia held erect, narrow-globose, 0.17–0.18 mm long, 0.07–0.08 mm wide; corpusculum 0.26–0.32 mm long, 0.05–0.07 mm wide; caudicles 0.29–0.3 mm long, 0.02–0.03 mm wide, geniculate 0.15–0.2 mm from the corpusculum. Follicles and seed not seen. Fig. 5.

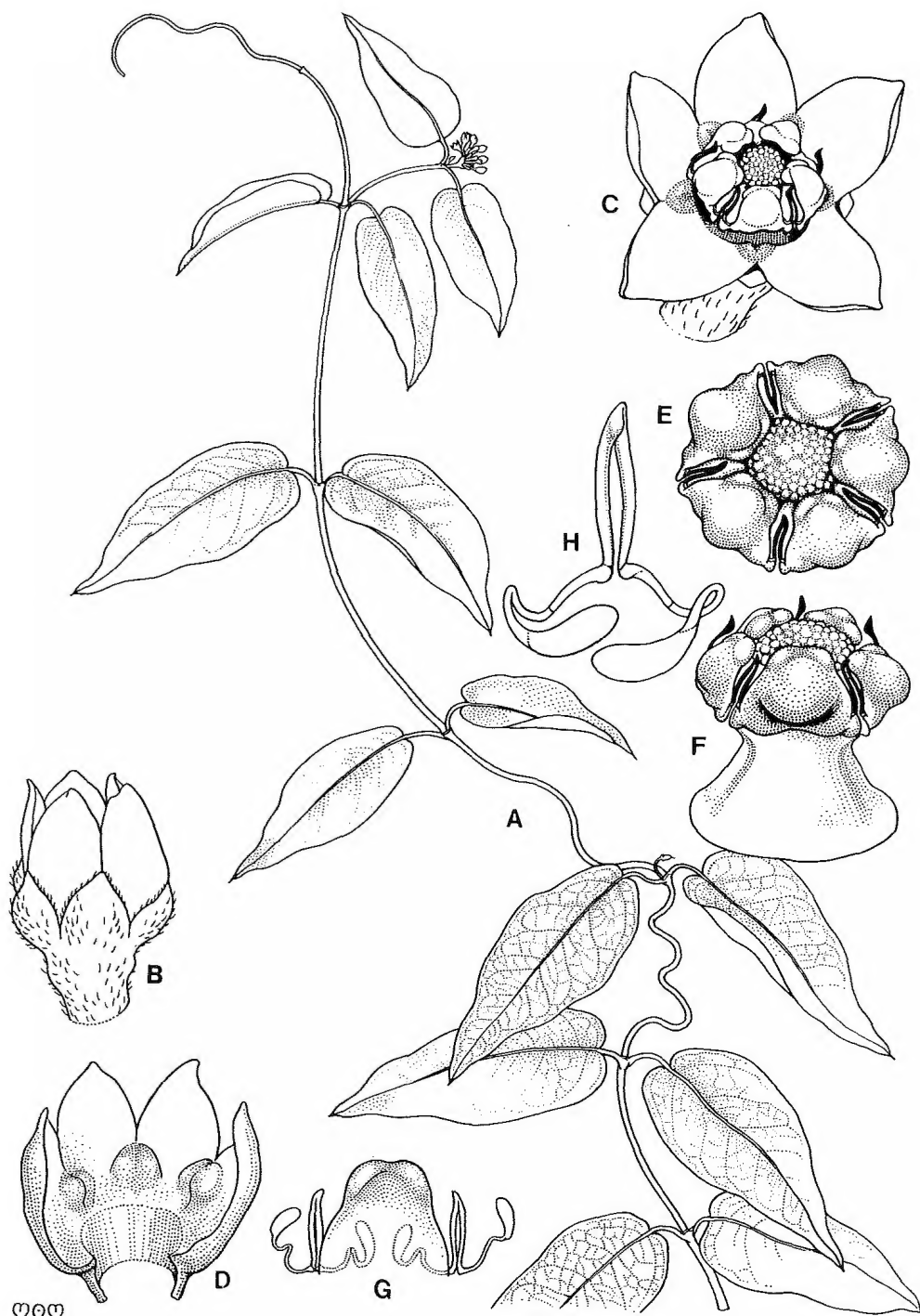


Fig. 5. *Sarcolobus vittatus*: A. habit of flowering branch $\times 0.5$. B. lateral view of flower $\times 10$. C. face view of flower $\times 10$. D. internal view of corolla showing corolline corona $\times 10$. E. face view of staminal column $\times 30$. F. lateral view of staminal column $\times 25$. G. lateral view of style-head showing disposition of pollinaria *in situ* $\times 88$. H. pollinarium $\times 165$. (All from Forster 6506 & O'Reilly). Del. M. Menadue.

Specimens examined: Irian Jaya. Merauke, Nov 1907, *Versteegh* 1886 (L). Papua New Guinea. MOROBE PROVINCE: Coast of Huon Gulf about 5 miles [8.3 km] NE of Lae, Jan 1963, *Hartley* 11079 (BRI,CANB). WESTERN PROVINCE: Upper Wassi Kussa River (left branch), 1939, *Brass* 8624 (A,BRI,L); Daru Island, Apr 1936, *Brass* 6452 (A,BRI,L). GULF PROVINCE: Paia Village near mouth of Omati River, Jan 1955, *Womersley & Simmonds* NGF5062 (BRI). Australia. Queensland. COOK DISTRICT: known only from type collection.

Distribution and habitat: *S. vittatus* occurs in Papua New Guinea and north Queensland (Map 4) in the narrow ecological band between mangroves and the adjoining vegetation.

Notes: *S. vittatus* is closely allied to *S. kaniensis* (Schltr.) P. Forster from New Guinea and differs mainly in the lack of small terminal lobes to the ridges comprising the corolline corona, and the absence of a staminal corona.

Conservation status: It seems remarkable that this taxon has been previously uncollected in Australia. A coding of 2K+ (cf. Briggs & Leigh 1988) is appropriate at this stage until further field work can be undertaken to determine the species abundance and distribution.

Etymology: The specific epithet alludes to the striped nature of the corolla lobes on the type plant.

Key to the species of *Sarcolobus* in Papuasias

1. Anther wings extending down staminal column below anthers 2
Anther wings not extending down staminal column below anthers 3
2. Staminal corona present; plant of mountains 4. *S. spathulatus*
Staminal corona absent; plant of mangroves 5. *S. oblongus*
3. Corolline corona present 4
Corolline corona absent 7
4. Corolline corona comprising 5 ridges in corolla throat terminating in 5
small free lobes; plant of mountains 6. *S. brachystephanus*
Corolline corona comprising 5 ridges or bulges in corolla throat, small
free lobes absent 5
5. Flowers greater than 6 mm in diameter 7. *S. globosus*
Flowers less than 5 mm in diameter 6
6. Corolline corona comprising five small bulges just below top of
corolla tube 3. *S. vittatus*
Corolline corona comprising five ridges running down length of
corolla tube 8. *S. kaniensis*
7. Staminal corona absent; plant of mangroves 9. *S. retusus*
Staminal corona present; plant of mountains or woodlands 8
8. Leaf lamina ovate-elliptic; corolla lobes with ridging in
centre towards base 10. *S. porcatus*
Leaf lamina elliptic to lanceolate-ovate; corolla lobes without ridging in
centre towards base 9
9. Pedicels 5–10 mm long; flowers 8–10 mm diameter 2. *S. hullsii*
Pedicels 1–4 mm long; flowers 3–4 mm diameter 11. *S. secamonoides*
4. *Sarcolobus spathulatus* P. Forster sp. nov. ad *S. secamonoidem* (Schltr.) P. Forster
affinis, a qua foliis ovato-ellipticis paribus venarum secundariarum 12 vel 13,
sepalis c. 1.5 mm longis, et tubo corollae c. 1.5 mm longo differt. **Typus:** Papua
New Guinea, MOROBE PROVINCE: Sattelberg, March 1936, *M.S. Clemens* 2239
(holo: BRI!; iso: ?A, n.v.).

Liane, latex colour unknown. Stems cylindrical, up to 3 mm diameter. Leaves petiolate; lamina ovate-elliptic, up to 8 cm long and 3.5 cm wide, discolorous; above green,

venation obscure, glabrous; below somewhat brownish (dried material), secondary veins 12 or 13 per side of midrib, tertiary venation reticulate, with sparse indumentum on veins and midrib; tip acuminate; base cuneate; petiole up to 1 cm long and 1 mm wide, grooved along top and with sparse indumentum; extrafloral nectaries 8 at base of lamina and also present up to 1 cm along midrib from base. Cyme umbelliform with 1–many flowers; peduncle up to 2 mm long and 1 mm diameter, glabrous; bracts ovate, c. 0.75 mm long and 0.5 mm wide, glabrous. Flowers rotate to subcampanulate, c. 2.5 mm long and 2.5 mm diameter; pedicels c. 2 mm long and 0.5 mm diameter, glabrous. Sepals ovate, c. 1.5 mm long, and 1.5 mm wide, base of each sinus with 1 gland. Corolla yellow; tube c. 1.5 mm long and 2 mm diameter; lobes lanceolate, c. 1.5 mm long and 1 mm wide. Corolline corona absent. Staminal corona comprising 5 lobes adnate to column below and not exceeding the anthers; each lobe oblong-spathulate, c. 0.5 mm long and 0.25 mm wide. Staminal column c. 1 mm long and 1 mm diameter; anther appendages ovate, c. 0.5 mm long and 0.5 mm wide; slit between anther wings c. 0.5 mm long, extending below anthers. Style-head c. 0.5 mm long and 0.5 mm wide. Ovaries c. 1 mm long and 1 mm diameter. Pollinarium c. 0.3 mm long and 0.35 mm wide; pollinia ovoid-globose, c. 0.2 mm long, 0.09–0.12 mm wide; corpusculum narrowly-oblong, 0.3–0.32 mm long and c. 0.06 mm wide; caudicles c. 0.19 mm long and 0.02–0.03 mm wide, geniculate c. 0.12 mm from corpusculum. Follicles and seed not seen. **Fig. 6.**

Specimens examined: Known only from the type collection.

Distribution and habitat: Morobe Province, Papua New Guinea (**Map 2**). This plant presumably grows in rainforest.

Phenology: Flowering in March.

Notes: This species is distinctive with respect to its spathulate coronal lobes which do not occur in any other species of the genus. *S. spathulatus* is similar to *S. secamonoides*, but differs primarily in the ovate-elliptic leaves with 12 or 13 secondary veins per side of the midrib.

The holotype at BRI is poor and comprises loose leaves and an inflorescence. On the label it is recorded as being a duplicate from A, however I did not find this collection in a loan of material from that institution.

Conservation status: Unknown.

Etymology: The specific epithet alludes to the spathulate coronal lobes.

5. *Sarcolobus oblongus* Rintz, *Blumea* 26: 77, 78 fig. 4 (1980). **Type:** Papua New Guinea. WESTERN PROVINCE: Daru Island, along the coast in mangroves, 5 March 1936, L.J. Brass 6278 (holo: A!; iso: BRI!, CANB!). Forster, *Austrobaileya* 3: 123 (1989).

Liane, latex white. Stems cylindrical, up to 10 mm diameter, glabrous; internodes up to 8 cm long. Leaves petiolate; lamina oblong, up to 12.5 cm long and 5.5 cm wide, discolorous; above dark green, glabrous, venation obscure; below pale green, secondary veins 10–15 per side of midrib, tertiary venation obscure, glabrous; tip obtuse-acuminate to mucronate; base cuneate; extrafloral nectaries 6–9 at lamina base; petiole grooved along top, 28–30 mm long, 1–2 mm wide, glabrous. Cyme umbelliform, up to 2 cm long, with 1–8 flowers; peduncle c. 7 mm long and 2 mm diameter, glabrous; bracts lanceolate, c. 5 mm long and 2 mm wide, glabrous or with scattered indumentum. Flowers campanulate, c. 3 mm long, 18–20 mm diameter; pedicels 4–5 mm long, c. 0.8 mm diameter, glabrous. Sepals ovate, c. 4 mm long and 3.5 mm wide, glabrous, ciliate, base of each sinus with 3 or 4 glands. Corolla dark purple; tube c. 4 mm long and 8 mm diameter; lobes lanceolate-ovate, c. 7 mm long, 4.6–5 mm wide, glabrous. Corolline corona consisting of a raised annulus at the top of the tube, c. 0.4 mm high. Staminal corona absent. Staminal column c. 1.8 mm long and 1.7 mm diameter; anther appendages narrow-ovate, c. 0.5 mm long and 1 mm wide; slit between anther wings 0.8–0.9 mm long, extending below anthers. Style-head depressed-globose, c. 1 mm diameter. Ovaries c. 1.2 mm long, 1–1.2 mm wide. Pollinarium c. 0.6 mm long and 1 mm wide; pollinia ellipsoid, 0.3–0.32 mm long, 0.14–0.15 mm wide; corpusculum 0.5–0.51 mm long, 0.1–0.11 mm wide; caudicles 0.4–0.42 mm long, 0.02–0.03 mm wide, geniculate 0.25–0.27

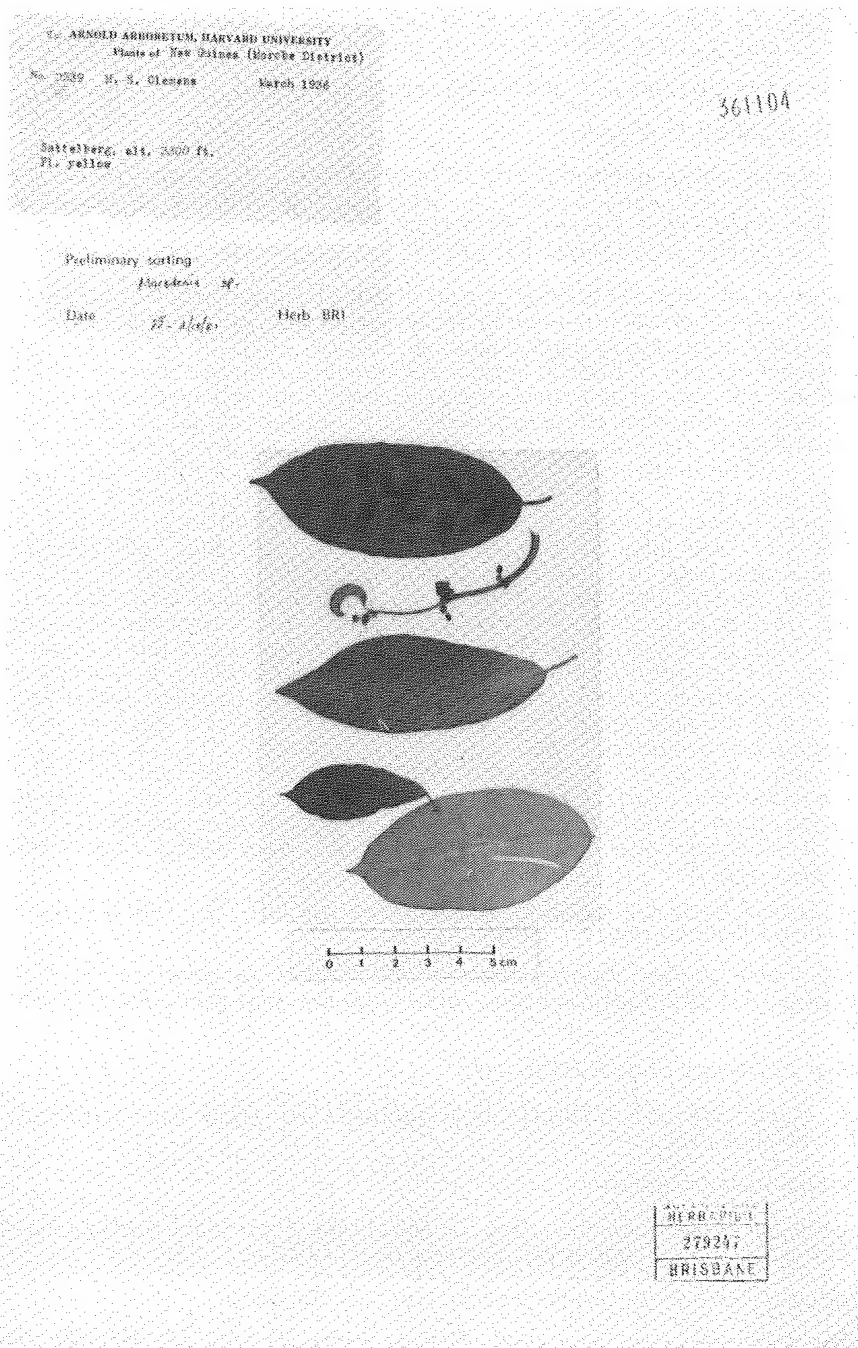


Fig. 6. *Sarcolobus spathulatus*: Photograph of holotype. (Clemens 2239, BRI).

mm from corpusculum. Follicles ovoid, 7.5–8 cm long and 4 cm wide. Seeds oblong, 2–2.5 cm long, 1.3–1.6 cm wide, lacking a coma.

Specimens examined: See Forster (1989).

Distribution and habitat: This species occurs in New Guinea (Rintz 1980) and the Solomon Islands (Forster 1989), where it grows in mangrove communities. **Map 3.**

Phenology: Flowering throughout the year; probably fruiting 3–4 months later.

Conservation status: Unknown.

6. *Sarcolobus brachystephanus* (Schltr.) P. Forster comb. nov. *Marsdenia brachystephana* Schltr. in Schumann & Lauterb., Nachträge fl. Schutzgeb. Südsee 367 (1905). **Type: Papua New Guinea. WEST SEPIK PROVINCE: Torricelli Geb., April 1902, R. Schlechter 14386 (holo: B†; iso: P!).**

Liane, latex white. Stems cylindrical, up to 3 mm diameter, glabrous; internodes up to 6 cm long. Leaves petiolate; lamina lanceolate-ovate to elliptic, up to 5 cm long and 3 cm wide, discolorous; above green, venation obscure, glabrous; below pale green, secondary veins 7 per side of midrib, tertiary venation reticulate, glabrous or with scattered indumentum; tip acute to acuminate; base cuneate; petiole grooved along top, up to 10 mm long and 0.8 mm wide; extrafloral nectaries 3–7 at base of lamina. Cyme comprising 1 or 2 umbelliform fascicles, up to 1.5 cm long; peduncle greatly reduced or up to 10 mm long and 0.5 mm diameter, with scattered to sparse indumentum; bracts lanceolate, c. 0.5 mm long and 0.2 mm wide, with a few cilia on edge, glabrous or with scattered indumentum. Flower subrotate to campanulate, 1.8–1.9 mm long, 3–4 mm diameter; pedicels 1.5–1.7 mm long, 0.4–0.5 mm diameter, with scattered indumentum. Sepals ovate, 1–1.5 mm long, 1–1.1 mm wide, ciliate, externally glabrous or with scattered indumentum, base of each sinus with 1 gland. Corolla cream; tube glabrous, 0.6–0.8 mm long, 1.8–2 mm diameter; lobes lanceolate-ovate, 1–1.5 mm long, 0.8–1 mm long, glabrous. Corolline corona absent. Staminal corona comprising 5 lobes adnate between the anthers and not exceeding them in length; each lobe oblong, c. 0.5 mm long and 0.2 mm wide. Staminal column c. 1 mm long and 1 mm diameter; anther appendages truncate, c. 0.1 mm long and 0.2 mm wide; slit between anther wings 0.3–0.4 mm long, not extending below anthers. Style-head globose-depressed, c. 0.5 mm long and 0.5–0.6 mm diameter. Ovaries c. 0.8 mm long and 0.5 mm wide. Pollinarium 0.32–0.4 mm long, 0.26–0.36 mm wide; pollinia globose-ovoid, 0.2–0.28 mm long, 0.08–0.12 mm wide; corpusculum 0.3–0.34 mm long, 0.07–0.09 mm wide; caudicles 0.13–0.19 mm long, c. 0.01–0.02 mm wide, geniculate 0.09–0.15 mm from corpusculum. Follicles and seed not seen. **Fig. 7.**

Specimens examined: Papua New Guinea. MADANG PROVINCE: Kani Geb., May 1908, Schlechter 17718 (P). MOROBE PROVINCE: Sattleberg, Jun 1937, Clemens 6514 (L).

Distribution and habitat: Madang, Morobe and West Sepik provinces in Papua New Guinea (**Map 3**). Collections have been made from montane rainforest at altitudes of c. 1100 m.

Phenology: Flowering from April to June.

Notes: *S. brachystephanus* is similar to *S. kaniensis* but differs most noticeably in the lack of a corolline corona.

Conservation status: Unknown.

7. *Sarcolobus globosus* Wallich, As. Res. 12: 568 (1818). **Type: India. Sundarbans, Wallich 789 (holo: C, n.v., fide Rintz, Blumea 26: 73 (1980)).**

Only the subsp. *peregrinus* (Blanco) Rintz occurs in Papuasia.

***Sarcolobus globosus* subsp. *peregrinus* (Blanco) Rintz, Blumea 26: 76, 74 fig. 3 (1980); *Asclepias peregrina* Blanco, Fl. Filip. ed. 2, 207 (1837); *Sarcolobus peregrinus* (Blanco) Schltr., Fedde Rep. 13: 564 (1915). **Type:** Philippines, Luzon: Bataan Prov., Limary, Merrill 7477 (neo: NA, n.v., fide Schltr., Fedde Rep. 13: 564 (1915)).**

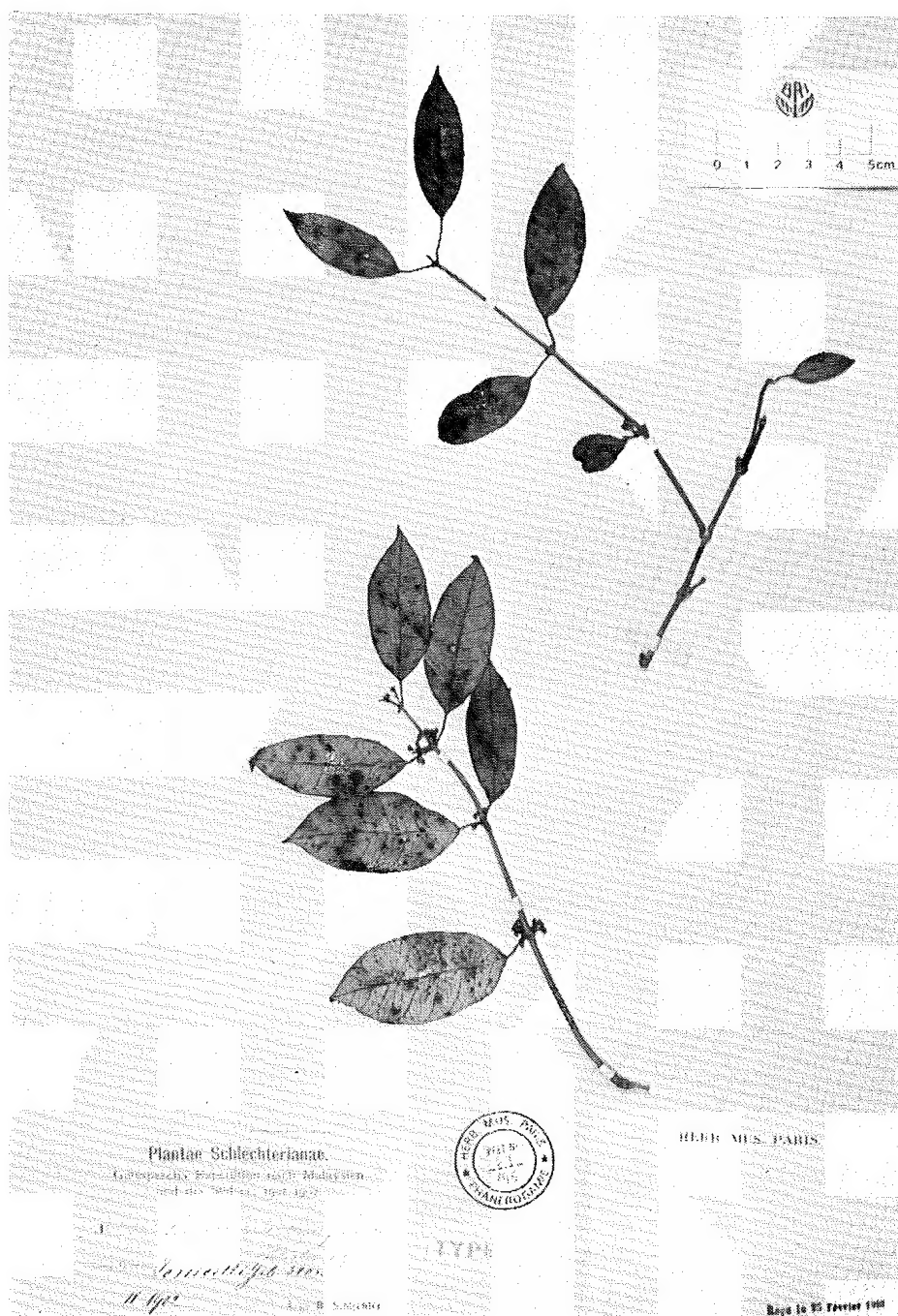


Fig. 7. *Sarcolobus brachystephanus*: Photograph of isotype. (Schlechter 14386, P).

Sarcolobus multiflorus Schumann & Lauterb., Nachträge Fl. Schutzgeb. Südsee 509 (1901). **Type:** Papua New Guinea. MOROBE PROVINCE: Finschhafen, *Lauterbach* 443 (holo: B, n.v., fide Rintz, *Blumea* 26: 76 (1980)).

Sarcolobus beccarii Warb., Fedde Rep. 3: 308 (1907). **Type:** Borneo, Sarawak, *Beccari* 699 (holo: K, n.v., fide Rintz, l.c.).

Sarcolobus minor Schltr., Beih. Bot. Centralbl. 34: 3 (1917). **Type:** Celebes, Toli-Toli, *Schlechter* 20715 (holo: B†).

Liane, latex white. Stems cylindrical, up to 5 mm diameter, with scattered to sparse indumentum; internodes up to 11 cm long. Leaves petiolate; lamina lanceolate-ovate, ovate or elliptic, up to 12 cm long and 5.5 cm wide, discolorous; above dark green, venation obscure, glabrous or with scattered indumentum; below pale green, secondary veins 5 or 6 per side of midrib, tertiary venation reticulate, with scattered indumentum particularly on veins; tip acute, acuminate or obtuse; base cordate to truncate; petiole grooved along top, 22–40 cm long, 0.8–1 mm wide, with scattered indumentum; extrafloral nectaries 18–20 at lamina base. Cyme umbelliform to racemiform, up to 3 cm long; peduncle 7–15 mm long, 0.8–1 mm diameter, with scattered indumentum; bracts lanceolate-ovate, 0.4–0.6 mm long and c. 0.3 mm wide, with scattered to sparse indumentum. Flowers campanulate, 1.6–2 mm long, 12–18 mm diameter; pedicels 8–12 mm long, 0.5–0.6 mm diameter, with scattered indumentum. Sepals lanceolate-ovate, 2–2.2 mm long, c. 1.5 mm wide, glabrous, ciliate, base of each sinus with 1 gland. Corolla yellow-green with red-brown longitudinal stripes on the lobes; tube c. 5 mm long and 10 mm diameter; lobes ovate, 5–5.4 mm long, 6.5–7 mm wide, glabrous or with scattered to sparse indumentum. Corolline corona comprising a raised annulus at the base of the staminal column. Staminal corona comprising 5 lobes adnate to staminal column below anthers; each lobe lanceolate-ovate to oblong, c. 5 mm long and 5 mm wide at base. Staminal column c. 1.8 mm long and 1.8 mm diameter; anther appendages triangular to truncate, c. 0.4 mm long and 0.4 mm wide; slit between anther wings c. 0.6 mm long, extending below anthers. Style-head depressed-globose, c. 0.8 mm diameter. Ovaries c. 1 mm long and 1 mm wide. Pollinarium c. 0.5 mm long and 0.9 mm wide; pollinia narrow-oblong, c. 0.35 mm long, 0.11–0.12 mm wide; corpusculum c. 0.4 mm long and 0.08 mm wide; caudicles 0.56–0.62 mm long, 0.02–0.03 mm wide, geniculate c. 0.4 mm from corpusculum. Follicles globose, c. 10 cm long and 7 cm wide. Seeds oblong, 2–2.6 cm long, 1.5–1.8 cm wide, lacking a coma.

Selected specimens: Papua New Guinea. WESTERN PROVINCE: Oriomo River, 8°50'S, 143°15'E, Jan 1959, *White & Gray* NGF10424 (BRI, L). GULF PROVINCE: 12 miles [20 km] inland from coast, east Purari River delta channel, Feb 1966, *Schodde* 4461 & *Craven* (BRI, L); Paia Village, near mouth of Omati Village, Jan 1955, *Womersley & Simmonds* NGF5061 (A, BRI). CENTRAL PROVINCE: Lower Fly River, east bank opposite Sturt Island, Oct 1936, *Brass* 8131 (BRI, CANB).

Distribution and habitat: This subspecies occurs widely in Malesia and in Western, Gulf and Central Provinces in Papua New Guinea (**Map 2**). Plants grow in mangrove communities.

Phenology: Flowering October to February.

Notes: Rintz (1980) took a broad view of this species with his two subspecies being markedly different in floral structure. As I have not seen material from the region where he claims overlap of characters occurs, no change is made in status for the taxon described here.

Conservation status: Unknown.

8. *Sarcolobus kaniensis* (Schltr.) P. Forster **comb. nov.** *Gymnema kaniense* Schltr., Bot. Jahrb. Syst. 50: 141 (1914). **Type:** Papua New Guinea. MADANG PROVINCE: Kani Geb., October 1907, *R. Schlechter* 16738 (holo: B†).

Liane, latex white. Stems cylindrical, up to 3 mm diameter, glabrous; internodes up to 7 cm long. Leaves petiolate; lamina elliptic to lanceolate-ovate, up to 8.5 cm long and 4 cm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 7 or 8 per side of midrib, tertiary venation obscure, glabrous or with scattered indumentum; tip acute to acuminate; base cuneate to rounded; petiole grooved on top, up to 12 mm long and 1 mm diameter, glabrous or with scattered indumentum; extrafloral nectaries 6–7 at lamina base. Cyme umbelliform, up to 2 cm long, comprising 2 fascicles; peduncle up to 1 mm long and 1 mm diameter, glabrous or with scattered



Fig. 8. *Sarcolobus kaniensis*. (Hartley 9699, CANB).

indumentum; bracts ovate, c. 0.5 mm long and 0.5 mm wide, ciliate. Flower campanulate to subrotate, c. 2 mm long and 3 mm diameter; pedicels 3–4 mm long, 0.3–0.5 mm diameter, glabrous or with scattered indumentum. Sepals ovate, c. 1 mm long and 1 mm wide, ciliate, base of each sinus with 1 gland. Corolla cream; tube c. 1 mm long and 1 mm diameter, glabrous; lobes ovate, c. 1.5 mm long, 1.2–1.25 mm long, glabrous. Corolline corona comprising 5 ridges in the corolla throat alternating with the lobes, each ridge c. 0.2 mm wide and terminating in a small lobe c. 0.1 mm long. Staminal corona comprising 5 lobes adnate to the staminal column; each lobe oblong, c. 0.5 mm long, 0.1–0.2 mm wide. Staminal column c. 0.75 mm long and 1 mm diameter; anther appendages truncate, c. 0.1 mm long and 0.2 mm wide; slit between anther wings c. 0.1 mm long, not extending below anthers. Style-head c. 0.5 mm long and 0.5 mm wide. Ovaries c. 0.5 mm long and 0.5 mm wide. Pollinarium c. 0.35 mm long and 0.35 mm wide; pollinia globose, 0.16–0.2 mm long, 0.06–0.08 mm wide; corpusculum c. 0.3 mm long and 0.07 mm wide; caudicles c. 0.23 mm long and 0.02–0.04 mm wide, geniculate approximately 0.14 mm from corpusculum. Follicles fusiform, 7–7.5 cm long and 3–4 mm wide, glabrous. Seed oblong, 5–6 mm long and 2 mm wide; coma 15–20 mm long, white. **Figs 8 & 10.**

Specimens examined: Papua New Guinea. MOROBE PROVINCE: Along Buko Creek, just S of Gurakor, 6°50'S, 146°38'E, Jan 1962, *Hartley* 9699 (CANB); Buko Creek, 3 miles [5 km] from Gurakor, 7°00'S, 146°40'E, Jan 1962, *Millar* NGF14448 (CANB).

Distribution and habitat: Madang and Morobe provinces in Papua New Guinea (**Map 2**). Collections have been made in rainforest at altitudes of 500–600 m.

Phenology: Flowering in January.

Notes: Although no isotypes of Schlechter's *G. kaniensis* have been located at BM, K, L or P, the species is well illustrated in Figure 8 in Schlechter's (1914) account and the Buko Creek collections seen (**Figs 8 & 9**) are a reasonable match for both Schlechter's figure and original description. Hence I am confident in applying this name to the material cited above.

The foliage of this species is difficult to distinguish from that of both *S. brachystephanus* and an undescribed species of *Marsdenia* collected by C.E. Carr (no. 14781 (CANB)) in southern Papua New Guinea. Any attempts to assign any other vegetatively similar collections should be undertaken only after making a full floral dissection.

Conservation status: Unknown.

9. *Sarcolobus retusus* Schumann in Schumann & Hollrung, Fl. Kais. Wilh. Land 109 (1889). **Type:** Papua New Guinea. MOROBE PROVINCE: Finschhafen, *Hollrung* 2 (iso: K, *n.v.*, *fide* Rintz, *Blumea* 26: 70 (1980)).

Schltr., Bot. Jahrb. Syst. 50: 159 (1914); Rintz, *Blumea* 26: 70, 71 fig. 2 (1980).

Sarcolobus ciliolatus Warb., Bot. Jahrb. Syst. 13: 408 (1891). **Type:** Moluccas, Aroe & Kei Is., *Warburg* 21317 (iso: BRI!; A, *n.v.*, *fide* Rintz, l.c.)

Tylophora sulphureus Volkens, Bot. Jahrb. Syst. 31: 473 (1902); *Sarcolobus sulphureus* (Volkens) Schltr., Bot. Jahrb. Syst. 50: 160 (1914). **Type:** Caroline Is., *Volkens* 347 (iso: BO, *n.v.*, *fide* Rintz, l.c.).

Sarcolobus quinquangularis Schltr., Fedde Rep. 3: 309 (1907). **Type:** Amboina, *Warburg* 17498 (iso: K, *n.v.*, *fide* Rintz, l.c.).

Sarcolobus lifuensis Guill., Bull. Soc. Bot. Fr. 74: 929 (1927). **Type:** Loyalty Islands, Lifou, *Balansa* 2405 (holo: P, *n.v.*, *fide* Rintz, l.c.).

Liane, latex white. Stems cylindrical, up to 5 mm diameter, with scattered indumentum; internodes up to 10.5 cm long. Leaves petiolate; lamina elliptic, up to 10 cm long and 6.5 cm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 5 or 6 per side of midrib, tertiary venation obscure, glabrous or with scattered indumentum on veins; tip acute, obtuse or mucronate; base cordate, rounded or cuneate; petiole 10–13 mm long and c. 1 mm diameter, with scattered to sparse indumentum; extrafloral nectaries 4–6 at lamina base. Cyme umbelliform to racemiform, up to 2.5 cm long; peduncle 7–8 mm long, 0.8–1 mm diameter, with scattered indumentum; bracts lanceolate-ovate, 0.4–0.5 mm long, 0.2–0.3 mm wide, with scattered indumentum. Flowers campanulate, 2.5–3 mm long, 11–15 mm diameter; pedicels 7–15 mm long, 0.4–0.5 mm diameter, glabrous or with scattered indumentum.

Sepals lanceolate-ovate, c. 2.3 mm long and 1.5 mm wide, glabrous, ciliate, base of each sinus lacking glands. Corolla yellow to brown, sometimes with longitudinal stripes on lobes; tube c. 2.5 mm long and 5 mm diameter; lobes lanceolate-ovate, c. 4 mm long and 3.5 mm wide, glabrous. Corolline corona absent. Staminal corona absent. Staminal column c. 1 mm long and 1 mm diameter; anther appendages ovate to truncate, c. 0.3 mm long and 0.3 mm wide; slit between anther wings c. 0.3 mm long, not extending below anthers. Style-head depressed-globose, c. 0.7 mm diameter. Ovaries c. 1.5 mm long and 1 mm wide. Pollinarium c. 0.4 mm long and 0.5 mm wide; pollinia oblong, 0.2–0.21 mm long, 0.1–0.12 mm wide; corpusculum 0.3–0.35 mm long, 0.08–0.1 mm wide; caudicles 0.25–0.27 mm long, 0.05–0.06 mm wide, geniculate c. 0.15 mm from corpusculum. Follicles ovoid, 5–6 cm long, c. 2.5 cm wide. Seeds ovate, 9–10 mm long, 6–7 mm wide, coma c. 2 cm long, white.

Selected specimens: Philippines. Palawan. St Paul's Bay, Underground River National Park, Sabang Beach, May 1984, *Risdale* SMHI1665 (BRI,CANB). Caroline Islands. Ngerukend, Belau (Palau), Jan 1988, *Rauleron* 16687 (BRI). Indonesia. Irian Jaya. Pocat Bay, Waigeo Is, Feb 1955, *van Royen* 5512 (A,L). Papua New Guinea. New Ireland: Katu Plantation, 26 miles [43 km] from Kavieng, 2°45'S, 151°06'E, *Coode & Copley* NGF29664 (BRI). NEW BRITAIN: Awul, 6°00'S, 151°02'E, Mar 1965, *Sayers* NGF21996 (BRI); Arawe Plantation, 6°10'S, 149°03'E, Mar 1966, *Henty & Frodin* NGF27258 (BRI). MOROBE PROVINCE: Sisilia River area, 5°29'S, 147°47'E, Sep 1974, *Conn & Katik* LAE66071 (BRI); Buso, 7°20'S, 147°10'E, Jun 1977, *Conn* 174 (L,MEL); Losanga Island, near Kui, 7°30'S, 147°15'E, Apr 1967, *Millar* NGF22842 (BRI,L). MILNE BAY PROVINCE: Wagalasa Island, 8°25'S, 150°30'E, Mar 1969, *Mann & Osborn* NGF43045 (BRI). Solomon Islands. SAN CRISTOBEL: Waimamura, Aug 1932, *Brass* 2562 (A,BRI).

Distribution and habitat: Widely distributed in Malesia. Collections have been made from Irian Jaya, Papua New Guinea and Solomon Islands (**Map 1**). I have seen no collections from Australia although the species may occur in mangrove communities in north Queensland.

Phenology: Flowering and fruiting throughout the year.

Conservation status: Not endangered or threatened.

10. *Sarcolobus porcatus* P. Forster sp. nov. ad *S. secamonoidem* (Schltr.) P. Forster affinis, a qua foliis ovato-ellipticis, corollis 3–5 mm longis et 5–6 mm diam., corona staminali ex lobis subulatis apicem styli superantibus constanti differt. **Typus:** Papua New Guinea. MOROBE PROVINCE: Bulolo Valley, 7°10'S, 146°10'E, April 1959, *J. Womersley* NGF11016 (holo: BRI!; iso: CANB!,L!);

Liane, latex colour unknown. Stems cylindrical, up to 4 mm diameter, glabrous or with scattered indumentum; internodes up to 9 cm long. Leaves petiolate; lamina ovate-elliptic, up to 8 cm long and 4 mm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 6–8 per side of midrib, tertiary venation reticulate, glabrous or with scattered to sparse indumentum mainly along veins and midrib; tip acute to acuminate; base rounded; petiole grooved along top, up to 16 mm long and 1 mm wide, with scattered to sparse indumentum; extrafloral nectaries 4–8 at lamina base. Cyme with 4–10 umbelliform fascicles, up to 8 cm long; peduncle 5–20 mm long and 0.7–1 mm diameter, with scattered to sparse indumentum; bracts lanceolate, 0.5–1 mm long, 0.25–0.3 mm wide, with scattered to sparse indumentum. Flower rotate to subcampanulate, 3–5 mm long, 5–8 mm diameter; pedicels 3–6 mm long and c. 0.5 mm diameter, with scattered to sparse indumentum. Sepals ovate, 1.5–1.9 mm long, 1–1.5 mm wide, ciliate, with sparse to dense indumentum externally, base of each sinus with 1 gland. Corolla white to creamy-white; tube 0.9–1.5 mm long, 1.6–3 mm diameter; lobes lanceolate, 2–3 mm long, 1–1.5 mm wide, glabrous, somewhat ridged along centre towards base. Corolline corona absent. Staminal corona c. 1 mm long and 2 mm diameter, comprising 5 lobes adnate to staminal column below the anthers, becoming free and just overtopping style-head; each lobe subulate, 0.5–1 mm long and 0.1–0.25 mm wide. Staminal column 1.4–2 mm long, 1.2–1.5 mm diameter; anther appendages truncate-ovate, 0.3–0.5 mm long, 0.3–0.5 mm wide; slit between anther wings 0.3–0.5 mm long, not extending below anthers. Style-head globose-depressed, 0.5–1 mm diameter. Ovaries c. 1.5 mm long and 1 mm wide. Pollinarium 0.35–0.4 mm long, 0.38–0.45 mm wide; pollinia oblong-ovoid, c. 0.25 mm long and 0.1 mm wide; corpusculum narrow-oblong, 0.35–0.41 mm long, 0.05–0.1 mm wide; caudicles geniculate c. two-thirds along from the point of attachment to the corpusculum, 0.15–0.17 mm long and 0.03–0.04 mm wide. Follicles and seed not seen. **Figs 9 & 10.**

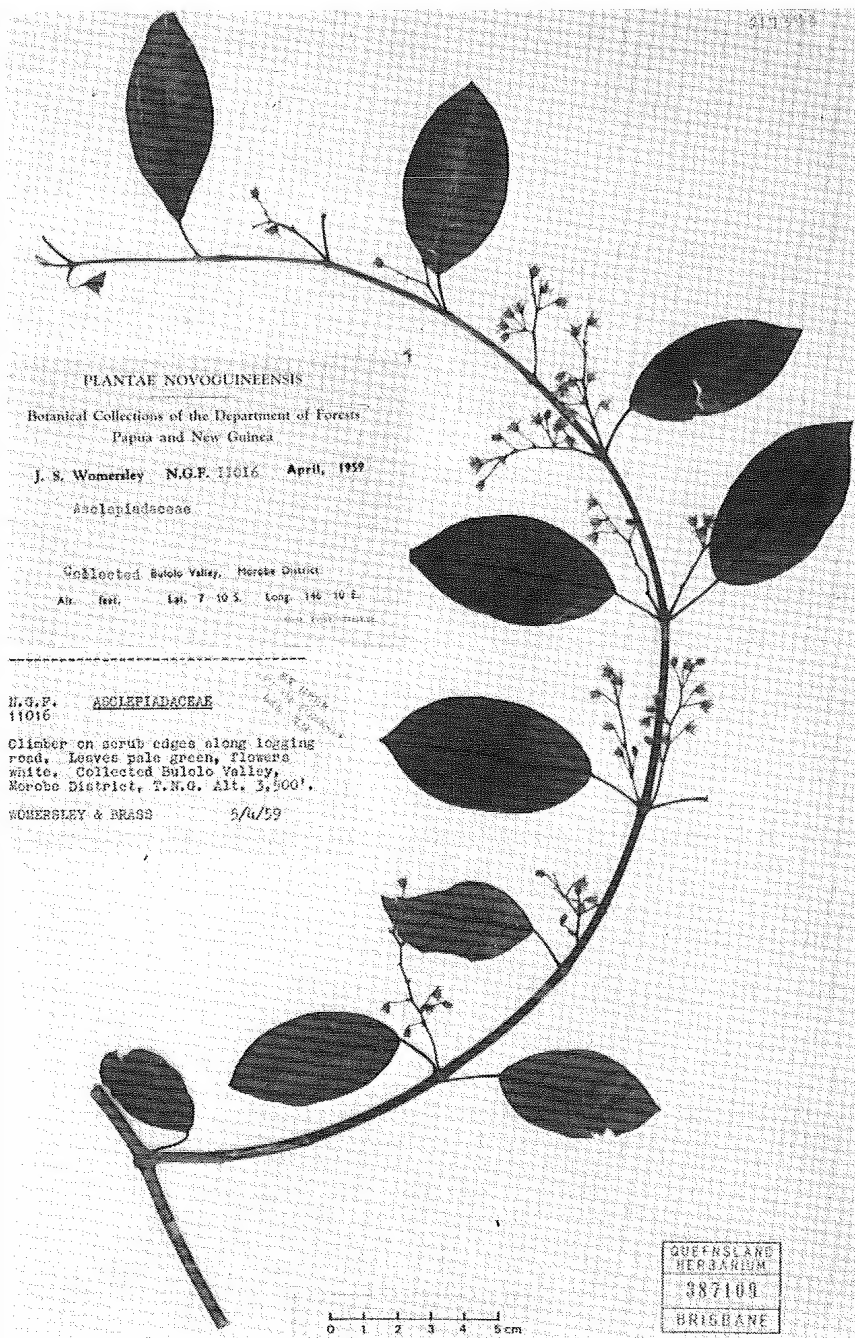


Fig. 9. *Sarcolobus porcatus*: Photograph of holotype. (Womersley NGF11016, BRI).

Specimens examined: Papua New Guinea. MOROBE PROVINCE: Kassam, 6°15'S 146°03'E, May 1967, *Kairo & Streimann* NGF35716 (BRI,CANB,L); Wau, 7°20'S, 146°45'E, Feb 1965, *Sayers* NGF21683 (BRI, L); Clean Water, Wau Forestry, 7°20'S, 146°45'E, Mar 1968, *Streimann & Kairo* NGF35828 (BRI,CANB); Bulolo, Apr 1959, *Brass* 29145 (CANB).

Distribution and habitat: Morobe province in Papua New Guinea (Map 4). This species has been collected from altitudes of 1060 to 1300 m in *Castanopsis* sp. dominated forest. Map 4.

Phenology: Flowering February to May.

Notes: *S. porcatus* is allied to *S. secamonoides* but differs in the ovate-elliptic leaf lamina, the 3–5 mm long and 5–6 mm diameter flowers and the staminal corona of subulate lobes overtopping the style-head.

Conservation status: Unknown.

Etymology: The specific epithet alludes to the *ridged* corolla lobes.

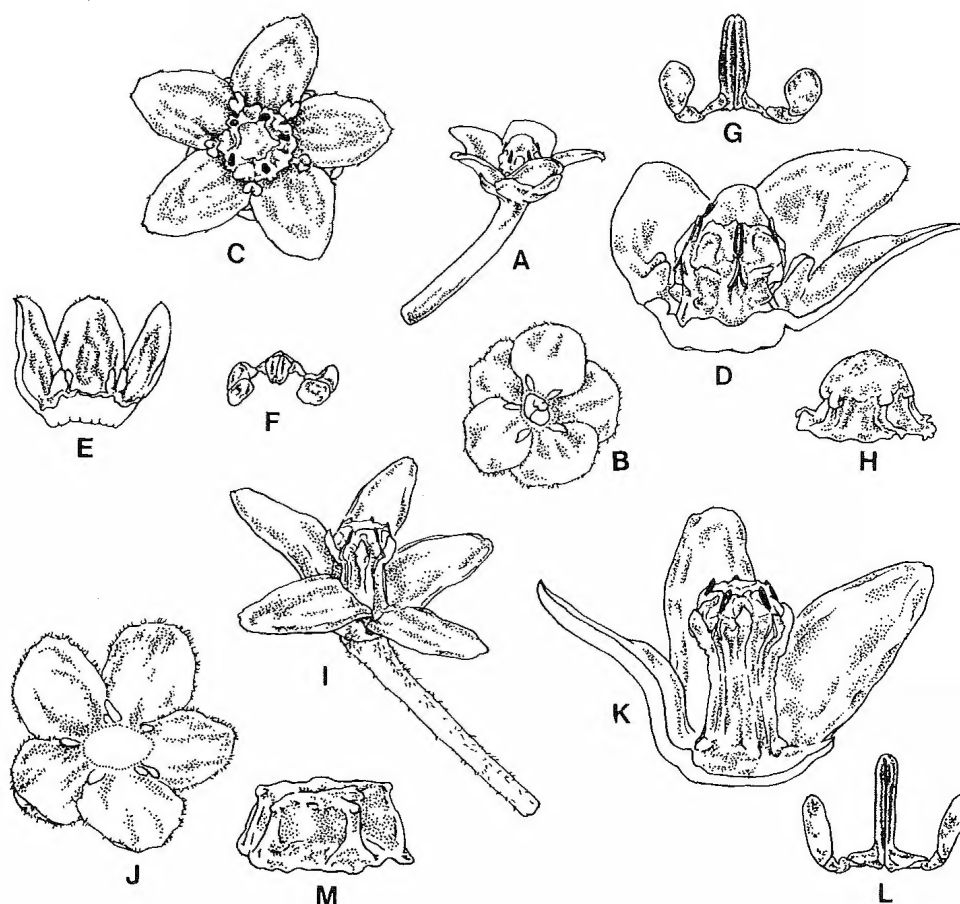


Fig. 10. A–H. *Sarcolobus kaniensis*: A. lateral view of flower $\times 6$. B. face view of calyx showing glands at sinus bases $\times 9$. C. face view of flower $\times 9$. D. lateral view of flower with corolla cutaway showing staminal column and staminal corona $\times 16$. E. internal view of partial corolla showing corolline corona $\times 9$. F. lateral view of pollinarium $\times 40$. G. face view of pollinarium $\times 40$. H. lateral view of style-head $\times 20$. I–M. *Sarcolobus porcatus*: I. lateral view of flower $\times 6$. J. face view of calyx showing glands at sinus bases $\times 9$. K. lateral view of flower with corolla cutaway showing staminal column and staminal corona $\times 9$. L. pollinarium $\times 40$. M. lateral view of style-head (somewhat distorted) $\times 20$. All from reconstituted material: A–H, Millar NGF14448, CANB; I–M, Streimann & Kairo NGF35828, BRI. Del. K. Harold.

11. *Sarcolobus secamonoides* (Schltr.) P. Forster comb. nov. *Astelma secamonoides* Schltr., Bot. Jahrb. Syst. 50: 140 (1914); *Papuastelma secamonoides* (Schltr.) Bullock, Kew Bull. 19: 202 (1964). Type: Papua New Guinea, MADANG PROVINCE: Torricelli Geb., September 1909, R. Schlechter 20051 (holo: B†; iso: K, n.v., photo at BRI!).

Liane, latex white. Stems cylindrical, up to 2 mm diameter, glabrous or with scattered indumentum when young, becoming lenticellate with age; internodes up to 9 cm long. Leaves petiolate; lamina lanceolate-ovate to lanceolate-elliptic, up to 7 cm long and 2.2 cm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 7–12 per side of midrib, tertiary venation reticulate, with scattered indumentum mainly on veins; tip acute; base cuneate; petioles grooved along top, 2–10 mm long and c. 1 mm wide, glabrous or with scattered to sparse indumentum; extrafloral nectaries 1–5 at lamina base. Cymes comprising 1–3 umbelliform fascicles, up to 1.5 cm long, often greatly reduced, usually paired at node; peduncle 0–7 mm long and 0.25–1 mm diameter, glabrous or with scattered to sparse indumentum; bracts triangular to lanceolate, 0.4–0.75 mm long, 0.25–0.5 mm wide, glabrous or with scattered to sparse indumentum. Flowers rotate, sweetly scented, 1.5–3 mm long, 3–4 mm diameter; pedicels 1–4 mm long and 0.25–0.75 mm diameter, glabrous or with scattered indumentum. Sepals ovate, slightly overlapping, 0.75–1 mm long, 0.75–1 mm wide, ciliate, externally with scattered to sparse indumentum, base of each sinus with 1–3 glands. Corolla white, cream or green; tube 0.5–1 mm long, 1.25–2 mm diameter, glabrous; lobes lanceolate-ovate, 1–2.5 mm long, 0.8–1.5 mm wide, glabrous. Corolline corona absent. Staminal corona consisting of 5 very small adnate lobes between the anther wings but not exceeding the anthers in length; each lobe oblong, 0.2–0.5 mm long, 0.1–0.2 mm wide. Staminal column yellow, 0.75–2 mm long, 1–1.5 mm diameter; anther appendages truncate and not exceeding the anthers; slit between anther wings 0.1–0.25 mm long, not extending below anthers. Style-head 0.3–0.5 mm long, 0.5–1 mm diameter, generally not exceeding anthers. Ovaries 1–1.5 mm long and c. 1 mm wide. Pollinarium 0.38–0.45 mm long, 0.35–0.5 mm wide; pollinia oblong-ovoid 0.25–0.35 mm long, 0.08–0.2 mm wide; corpusculum 0.35–0.42 mm long, 0.07–0.08 mm wide; caudicles 0.15–0.25 mm long, 0.02–0.05 mm wide, geniculate approximately in middle. Follicles fusiform, glabrous, c. 47 mm long and 4 mm wide. Seed not seen. Figs 11 & 12.

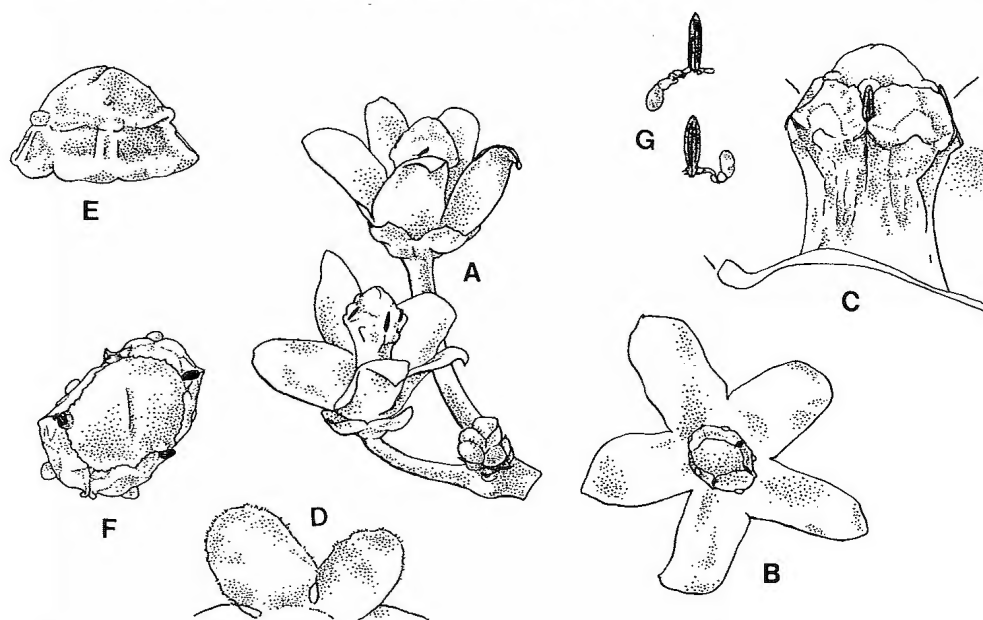


Fig. 11. *Sarcolobus secamonoides*: A. partial cyme with two flowers $\times 27$. B. face view of flower (somewhat distorted) $\times 27$. C. lateral view of staminal corona and staminal column $\times 63$. D. face view of calyx with corolla removed $\times 42$. E. lateral view of style-head (faintly papillate) $\times 73$. F. face view of staminal corona and staminal column (somewhat distorted) $\times 63$. G. pollinarium $\times 73$. All from reconstituted material of Vink 16397, BRI. Del. K. Harold.



Fig. 12. *Sarcolobus secamonoides*. (Womersley NGF11425, BRI).

Specimens examined: Papua New Guinea. EAST SEPIK PROVINCE: Etappenberg, Oct 1912, *Ledermann* 9459 (L). WESTERN HIGHLANDS PROVINCE: Kubor Range, Uinba, Nona-Minj Divide, Aug 1963, *Vink* 16397 (CANB). EASTERN HIGHLANDS PROVINCE: Kini Creek, NE slopes of Mt Michael, 6°25'S, 145°20'E, Sep 1959, *Womersley* NGF11425 (BRI,CANB); Mt Michael, northeast slopes, Sep 1959, *Brass* 31338, 31529 (CANB). MADANG PROVINCE: N Kalronk Valley, Aug 1964, *Bulmer* 207 (LAE). MOROBE PROVINCE: track, Angabena ridge – Aseki, 7°20'S, 146°10'E, *Streimann & Stevens* LAE53999 (BRI,CANB,L); Kisingam, Mt Dilmargi, 6°20'S, 146°35'E, Dec 1972, *Stevens* LAE58027 (BRI,CANB); New Yamap, head of Baime River, 7°05'S, 146°50'E, Dec 1969, *Streimann & Kairo* NGF44462 (BRI,CANB); Matap, Feb-Apr 1940, *Clemens* 40932 (BRI); Ogeram nang, Jan 1937, *Clemens* 5062 (BRI); Sambangan, Aug 1937, *Clemens* 6779 (L); Samanzing, Oct 1938, *Clemens* 9728A (L). CENTRAL PROVINCE: Efoji environs, Owen Stanley Range, Sep 1970, *Schodde* 5704 (BRI,CANB); Isuarava, 8°59'S, 147°43'E, Feb 1936, *Carr* 15325, 15459 (CANB).

Distribution and habitat: *S. secamonoides* is widely distributed in Papua New Guinea (Map 1) where it grows in montane primary or secondary forest often dominated by *Nothofagus* species at altitudes of 1490 to 2000 m.

Phenology: Flowering throughout the year.

Notes: *S. secamonoides* is similar to *S. spathulatus* but differs most noticeably in the lanceolate-ovate to lanceolate-elliptic leaves with 7–12 secondary veins per side of the midrib.

Conservation status: Unknown.

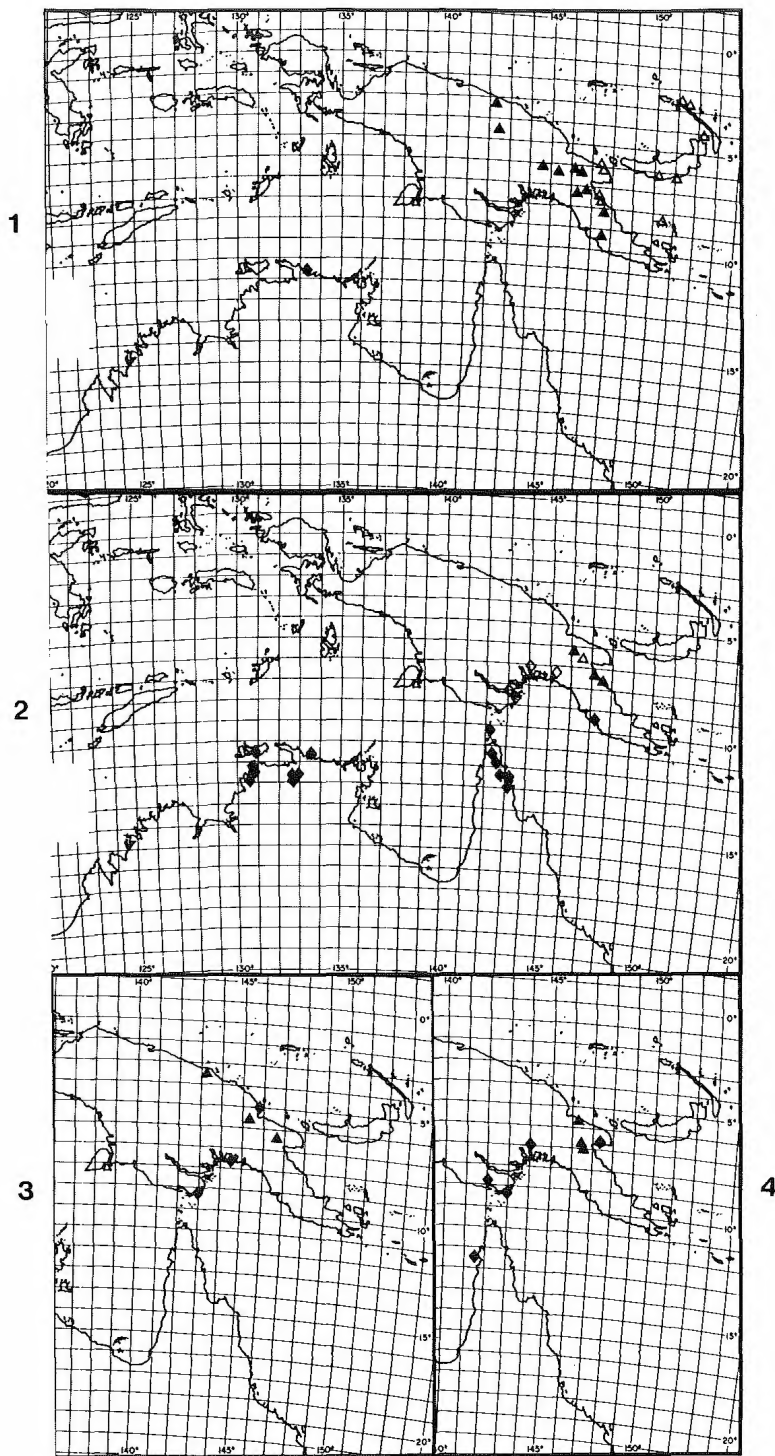
Ethnobotanical use: The label of *Bulmer* 207 records that this species is used for fencing and home building and was known as “Wogukesinlk”.

Acknowledgements

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Maps 1-4: Distribution of *Sarcolobus* spp.: 1. *S. retusus* △; *S. secamonoides* ▲; *S. ritae* ◆. 2. *S. spathulatus* △; *S. kaniensis* ▲; *S. globosus* subsp. *peregrinus* ◇; *S. hullsii* ◆. 3. *S. brachystephanus* ▲; *S. oblongus* ◇. 4. *S. porcatus* ▲; *S. vittatus* ◆.

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THE GENUS *EMBELIA* N. BURMAN (MYRSINACEAE) IN AUSTRALIA

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Summary

Embelia N. Burman is represented by four species in Australia of which three are new, viz *E. caulialata*, *E. curvinervia* and *E. grayi*. All species are described with notes on their affinities and distribution. A key to distinguish the species is also provided.

Introduction

The genus *Embelia* in Australia was previously represented by only the well known *E. australiana* (F. Muell.) Bailey, and two or three undescribed taxa closely related to this species. The other species described from Australia was correctly placed in *Tapeinosperma flueckigeri* (F. Muell.) Mez.

Increased recent collecting due mostly to various floristic projects in Queensland and Northern Territory has provided a sufficient number of representative specimens in this genus to adequately understand the previously poorly known new species and to allow the description of the following species, so that they can be included in the Census of Queensland Plants.

Two of the new species viz *E. grayi* and *E. curvinervia* are closely related to *E. australiana*, and are known only from Australia, while *E. caulialata* is quite distinct and extends into Papua New Guinea.

Taxonomy

Embelia N. Burman, Fl. Ind. 62, t.23 (1768); Mez, Pflanzenr. 9: 295–332 (1902). **Type:** *E. ribes* N. Burman

Derivation of name: *Embelia*, a vernacular name for one of the species viz *E. ribes*, from Sri Lanka.

Dioecious scandent shrubs or vines. Leaves petioled, distichous or spirally arranged, entire (Australian species), glabrous, dotted with red brown or black glandular dots or streaks. Inflorescences axillary or terminal, fascicled or solitary, racemose or paniculate, sometimes subumbellate. Flowers small, 4- or 5-merous; pedicellate; calyx deeply lobed, lobes imbricate; petals free or slightly connate at their base, imbricate or contorted, usually papillate on the inner side and along the margins, mostly glabrous outside; stamens and staminodes usually inserted towards the base of the petals, stamens longer or shorter than petals; filaments subulate, glabrous; anthers dorsifixed, longitudinally dehiscent, usually dorsally punctate and verrucose with a cluster of wart-like glands above point of attachment with the filament; ovary in male flowers minute, in females globose or ovoid, few-ovuled; style short, persistent; stigma broad, disciform. Fruit a drupe, usually globose to subovoid, apiculate (persistent style), usually drying black; seed subglobose.

About 130 species (Mabberley 1989), in Asia, Malesia, western Pacific and Australia. Four in Australia.

Key to the species

1. Flowers 5-merous; inflorescences paniculate, large, 6–19.5 cm long. Leaves with 16–18 pairs of fine, slender lateral nerves; apex acuminate; lamina 2.5–3.5 times as long as wide; young stems usually winged . . . 1. *E. caulialata*
- Flowers 4-merous; inflorescences racemose, subumbellate or paniculate, small, 0.3–9.5 cm long. Leaves with 5–8 pairs of prominent lateral nerves; apex usually obtuse; lamina less than 2 times as long as wide; young stems not winged 2

2. Panicles terminal, 3–9.5 cm long, branching from the base; flowers subsessile, pedicels to 1.5 mm long; fruits to 4×4 mm. Leaves thinly coriaceous, lateral nerves strongly arched and ascending . . . 2. *E. curvinervia*
 Racemes or subumbels axillary or terminal, 0.3–3.5 cm long; flowers conspicuously pedicellate, pedicels 1.5–6 mm long; fruits to 9.5×9 mm. Leaves thinly or thickly coriaceous, sometimes thick, $\pm$ rigid, lateral nerves $\pm$ oblique or patent and looping near margins 3
3. Racemes 9–17-flowered; peduncles 1–3.3 cm long, densely papillose; sepals narrowly ovate, acuminate, not dotted; stamens longer than the petals. Leaves with broad usually truncate bases, reticulate veins closely arranged; petioles 10–17 mm long 3. *E. grayi*
 Racemes or subumbels reduced, 3–7-flowered; peduncles 1–7(–20) mm long, glabrous; sepals broadly ovate, abruptly acuminate, black-dotted; stamens shorter or as long as the petals. Leaves with subacute or rarely broad bases; reticulate veins laxly arranged; petioles 5–7(–10) mm long 4. *E. australiana*

1. *Embelia caulialata* S. Reyn. sp. nov. a speciebus ceteris Australianis caulibus juniores angulatis plerumque angustialatis, foliis anguste ellipticis, et inflorescentiis paniculatis, floribus pentameris differt. **Typus:** Queensland, COOK DISTRICT: Cape Tribulation, 16°05'S, 145°29'E, 28 May 1982, K.A.W. Williams 82050 (holo: BRI).

Scrambling shrubs or vines; stems to 8 cm diameter, pale brown with loose bark and scattered lenticels, young stems angular and usually narrowly winged. Leaves narrowly elliptic, $8.5\text{--}13.1 \times 3.8\text{--}4.5$ cm (juvenile leaves to 16×3 cm, with long acumen), shortly acuminate at apex; margins entire; base subacute; thinly coriaceous; lower surfaces pale, densely black-dotted with $\pm$ globose glandular dots; midrib sunken above; lateral nerves 16–18 pairs, very slender, patent, $\pm$ parallel; reticulate venation obscure; petioles 6–10 mm long, deeply channelled above. Inflorescences axillary or terminal, paniculate, densely flowered, male panicles $6\text{--}10 \times 7\text{--}10$ cm, females $7\text{--}19.5 \times 5\text{--}14$ cm; peduncles pubescent with thick short spreading reddish brown hairs; branches patent, 3.5–8 cm long (female panicles with longer branches); bracts narrowly ovate, $1.5\text{--}3 \times 0.5\text{--}1$ mm, glabrous, sparsely ciliate. Flowers 5-merous, creamy green, slightly perfumed; pedicels 1–1.5 mm long, patent hairy; calyx to 1×1.5 mm, lobed to near base; lobes broadly ovate, $0.5\text{--}0.7 \times 0.5\text{--}0.7$ mm, usually erose, membranous, glabrous, ciliolate; petals imbricate, elliptic, $1.5\text{--}2 \times 1$ mm, glabrous outside except papillose margin, densely papillose inside; stamens longer than petals, exserted; filaments 1–1.25 mm long; anthers shorter than filaments, to 0.5×0.5 mm, broadly obloid to ovoid, verrucose dorsally; staminodes to 0.7 mm long; ovary glabrous, ovoid; stigma disciform or capitate. Drupes subovoid, $3\text{--}3.5 \times 3$ mm, reddish purple to maroon, usually black when ripe. **Fig. 1G–O.**

Selected specimens: Papua New Guinea. Wariorata Sogeri subdistrict, Central Division, Mar 1986, Womersley NGF 8765 (BRI). Australia. Queensland. COOK DISTRICT: Between Lockerbie and Somerset, $10^{\circ}47'S$, $142^{\circ}30'E$, Dec 1980, Hyland 10948 (BRI, QRS); Mt Tozer near Iron Ra., $12^{\circ}45'S$, $143^{\circ}12'E$, Nov 1977, Tracey 14839 (BRI); between Gap Ck. and Bloomfield beach, May 1969, Smith (BRI); T.R. 176, Monkhouse, $15^{\circ}45'S$, $145^{\circ}16'E$, near Shipton's Flat, Oct 1982, Hyland 12137 (BRI, QRS); Rex Ra. $16^{\circ}34'S$, $145^{\circ}18'E$, Sep 1985, Goodwin & Tracey C2924 (BRI); Wopen Ck Rd, $17^{\circ}27'S$, $145^{\circ}33'E$, Aug 1989, Gray 20262 (BRI, QRS); Clump Point, $17^{\circ}52'S$, $145^{\circ}35'E$, May 1945, Flecker 9336 (BRI, QRS).

Distribution and habitat: Northeastern Queensland, from Cape York Peninsula to Clump Point, near Mission Beach (Map 2), also in southern New Guinea; usually along creeks on alluvial soils in mesophyll vine forests or swampy forests.

E. caulialata is distinguishable from all the other *Embelia* species in Australia, by its large paniculate inflorescences, 5-merous creamy green flowers, narrow elliptic leaves, and usually winged young angular stems. It appears to be closely related to *E. cotinoides* (S. Moore) Merr. from New Guinea which also has 5-merous flowers, but the latter species has broad elliptic leaves, black-dotted calyx, petals and fruits, and stamens with long anthers and very short filaments.

Etymology: The specific epithet (*cauli* (Latin), stem, *alata* (Latin), wing) refers to the usually winged (especially young) stems.



Fig. 1. A-F. *Embelia curvinervia*: A. branchlet with flowers $\times 0.67$. B. male flower $\times 8$. C. calyx $\times 12$. D. petal with stamen $\times 12$. E. anther $\times 25$. F. fruit $\times 6$. G-O. *Embelia caulialata*: G. portion of adult stem $\times 0.67$. H. portion of young stem with narrow wings $\times 1$. I. female inflorescence $\times 0.5$. J. male flower $\times 8$. K. female flower $\times 8$. L. calyx $\times 12$. M. petal with stamen $\times 12$. N. dorsal view of stamen, showing glands at point of attachment of filament and anther $\times 25$. O. fruit $\times 6$. A-E, Wightman 325 & Dunlop; F, Russell-Smith 6102 & Lucas; G,H, Webb & Tracey 9266; I,K,L, Williams 82050; J,M,N, Flecker 9336; O, Godwin & Tracey C2924.

2. *Embelia curvinervia* S. Reyn. sp. nov. quoad flores ad *E. australianam* (F. Muell.) Mez accedit, sed ab ea differt inflorescentiis paniculatis multo majoribus, fructibus parvulis, nervis lateralibus conspicuis, gracilis, valde arcuato-ascendentibus. **Typus:** Northern Territory. Near Bull Creek, 13°53'S, 131°17'E, 2 July 1946, S.T. Blake 16287 (holo: BRI; iso: BRI).

Scandent shrubs or vines; stems usually densely lenticellate with broadly ellipsoid, pale lenticels; young branchlets with scattered, small, rusty brown club-shaped hairs. Leaves broadly elliptic or ovate-elliptic, 5.5–8.7(–12.7) × 3.5–6(–7.3) cm, apex obtuse or ± rounded; margins entire; base subobtuse or subtruncate; thinly coriaceous, shiny, green above, pale and dull below, usually with scattered ellipsoid or subglobose pellucid red-brown to black dots, the dots denser at margins; conspicuously nerved and reticulate veined; lateral nerves 5–9 pairs, slender, oblique, strongly arched and ascending at tips and looping away from margins; reticulate venation laxly arranged; petioles 1.5–2.2 cm long, channelled above. Inflorescences terminal, usually paniculate, branching from the base, 13–17-flowered, male panicles 3–5.5 cm long, females 8–9.5 cm long; branches patent, 1–4.8 cm long, peduncles sparsely hairy, with thick, short, ± club-shaped, brown, sometimes glandular hairs, and crinkly long multicellular hairs; bracts small, narrowly ovate or linear, 1–2.5 × 0.7–1 mm, densely hairy with long reddish, multicellular, crispate hairs. Flowers 4-merous, cream to dark-orange, slightly perfumed; pedicels 0.5–1.5 mm long, sparsely hairy with thick short hairs; calyx 0.8–1.5 × 1.5–2 mm, lobed to near middle, glabrous, cream or purplish, lobes narrowly ovate, 0.7–1.3 × 0.5–0.7 mm, sparsely black glandular-dotted; petals imbricate, elliptic or ovate-elliptic, occasionally shortly clawed, auriculate above the claw and enclosing the filaments, 1.5–2 × 1 mm, obtuse, cream or purplish on outsides and usually sparsely dotted with minute black dots, glabrous except papillose margins; orange inside and covered with dense, thick, short, often glandular papillae; stamens longer than petals, filaments 1.5–3 mm long; anthers shorter than filaments, 0.5–0.7 × 0.5 mm, broadly ovoid or obloid, rarely verrucose dorsally, pale yellow; staminodes shorter than petals; ovary globose, glabrous; styles to 1 mm long; stigma capitate. Drupes globose, to 4 × 4 mm, ripening red; pericarp thin, ribbed and wrinkled when dry. **Fig. 1A–F.**

Selected specimens: Northern Territory. Black Jungle, 12°33'S, 131°14'E, Nov 1982, *Wightman* 306 (BRI,DNA); Berry Springs, Jul 1971, *Baloogy* 1426 & *Byrnes* (DNA); Stapleton, Numuru Ck, Oct 1988, *Russell-Smith* 6102 & *Lucas* (BRI,DNA); Channel Point, 13°10'S, 131°17'E, Nov 1982, *Wightman* 326 & *Dunlop* (DNA); Adelaide R. – Daly R. Rd, 13°29'S, 131°04'E, Aug 1978, *Dunlop* 5025 (BRI); near Bull Ck, 13°53'S, 131°17'E, Jul 1946, *Blake* 16287 (BRI). Queensland. COOK DISTRICT: Claudie R., towards Tozer's Gap, 12°45'S, 143°15'E, Oct 1984, *Gray* 3648 (BRI,QRS); ditto, Oct 1986, *Hyland* 21192 (BRI).

Distribution and habitat: Northern Australia, from Channel Point to near Goodparla Station, Northern Territory, and near Claudie R., Cape York Peninsula, Queensland (**Map 1**); usually near permanent water, viz rivers, creeks and streams, in monsoon forests.

E. curvinervia is distinguishable by its shiny, usually thinly coriaceous leaves with conspicuous strongly arched and ascending lateral nerves, paniculate inflorescences terminating branchlets, 4-merous cream to dark orange flowers and small fruits. It approaches *E. australiana* of which it has the 4-merous flowers, but the latter species differs particularly by its very small racemose or subumbellate, few-flowered inflorescences and large fruits.

E. curvinervia also appears to be closely related to *E. frangulifolia* (Span.) Mez from Timor, but the type of the latter species (Timor, *Spanoghe* s.n. (L)), and a few collections of this species available for study, differ from the former species in its fairly thin leaves, very fine slightly oblique lateral nerves and smooth dry fruits.

Etymology: The specific epithet (*curvi* (Latin), curved; *nervia* (Latin), nerves) refers to the strongly arched ascending lateral nerves.

3. *Embelia grayi* S. Reyn. sp. nov. *E. australianam* (F. Muell.) Mez aemulans differt racemis longioribus elongatis, dense papillois, calycibus eglandulosis et foliis tenuioribus, dense conspicue reticulato venosis. **Typus:** Queensland. NORTH KENNEDY DISTRICT: S.F.R. 194 adjacent to Por. 69 Herberton, 17°28'S, 145°28'E, altitude 1000 m, 28 November 1978, *B. Gray* 1153 (holo: BRI; iso: BRI,QRS).

Vine with densely lenticellate stem; lenticels globose or ellipsoid, pale, contrasting with dark brown stem; young parts, peduncles and pedicels with short red papillae. Leaves



Map 1-3. Distribution of *Embelia* spp.: 1. *E. curvinervia* ▲; *E. grayi* ○. 2. *E. caulialata* ○. 3. *E. australiana* ○.

broadly elliptic or oblong-elliptic, 4-6.8(-8.5) × 2.5-4.7(-7) cm, obtuse at both ends, or truncate at base; glabrous or with scattered papillae on the midrib below, shiny above, pale below, ± rigid, usually densely dotted with transparent globose glandular dots and streaks; midrib sunken above; lateral nerves 7-9 pairs, ± oblique or patent, looping near margins; reticulate venation closely arranged, forming a fine mesh, conspicuous; petioles 1-1.7 cm long, grooved above. Inflorescences in the axil of leaves or old leaves, racemose, 1.2-4 cm long, 9-17-flowered, male racemes usually shorter than the females; peduncles 1-3.3 cm long, densely papillose with red papillae; bracts narrowly ovate to ovate-oblong, to 4 × 1 mm, papillose. Flowers 4-merous, pinkish cream; pedicels patent, male pedicels 1.5-2.5 mm long, females 3-4.5 mm long; calyx to 1.25 × 2.5 mm, lobes divided to near base, narrowly ovate, 0.5-1 × 0.2-0.5 mm, sparsely papillose outside; petals imbricate, ovate-elliptic or elliptic, 1.25-2.5 × 1-1.25 mm, apex acuminate or obtuse, recurved, papillose inside; stamens longer than petals; filaments longer than anthers, 1.5-2 mm long, exserted; anthers ovoid, to 0.5 × 0.5 mm, not punctate dorsally; staminodes to 1.25 mm long; styles to 1.5 mm long, sparsely papillose, stigma lobed. Fruits not seen.

Selected specimens: Queensland. COOK DISTRICT: Gadgarra S.F.R., 17°15'S, 145°45'E, Jul 1971, *Hyland* 5273 (BRI,QRS); Yungaburra, date unknown, *Bick* AQ 91599 (BRI); Waugh's Pocket, Oct 1945, *Flecker* 9679 (BRI,QRS). NORTH KENNEDY DISTRICT: S.F.R. 194 adjacent to Por. 69, Herberton, 12°28'E, 145°28'E, Nov 1978, *Gray* 1153 (BRI,QRS).

Distribution and habitat: Northeastern Queensland, around Atherton Tableland (Map 1); in high altitude rain forests and in *Hypoetrum* sp. swamp.

E. grayi is distinguishable by its long, densely papillose, racemose inflorescences, 4-merous pinkish cream flowers, and closely reticulate-veined broad elliptic leaves. It is comparable to *E. australiana* of which it has the flowers, but the latter species has fairly thick, laxly reticulate-veined leaves, and very reduced, few-flowered inflorescences usually terminating short branchlets.

Etymology: The species is named in honour of Mr Bruce Gray (QRS), the collector of the type, for his contribution to our knowledge of Australian rainforest plants especially climbing plants.

4. *Embelia australiana* (F. Muell.) Bailey*, Qd Fl. 3: 950 (1900); *Choripetalum australianum* F. Muell., Fragm. 3:36 (1862). **Type:** New South Wales. Clarence River, *H. Beckler* s.n. (*n.v.*).
Mez, Pflanzenreich. 9: 331(1902).

Samara australiana (F. Muell.) F. Muell., Fragm. 6: 164 (1868).
Benth., Fl. austral. 4: 274 (1869).

Scandent shrubs or vines, stems thick with pale brown bark, usually densely lenticellate with conspicuous red ellipsoid lenticels; branchlets often zig-zag, glabrous. Leaves variable in size, elliptic or elliptic-obovate, 2.6–8.5(–10.5) × 1.2–4(–5.2) cm (juvenile leaves ovate or elliptic, 11 × 6.7–7.5 cm), apex obtuse or rounded; base subacute or cuneate, rarely obtuse or truncate; subcoriaceous, sometimes rigid, glossy green to yellowish, densely dotted with conspicuous globose, oblong or ellipsoid, pellucid or opaque, reddish brown or blackish dots; lateral nerves oblique or patent, ascending and looping near margins; reticulate venation lax, prominent especially below; petioles 5–10 mm long, flexuose, reddish. Inflorescences usually terminating short branchlets, racemose or rarely subumbellate, 3–7-flowered; peduncles 1–7(–20) mm long, glabrous, rarely sparsely papillose; bracts ovate, 0.5–0.8 × 0.5–0.8 mm, sparsely papillose to glabrous, black-dotted. Flowers 4-merous; pedicels 3–6 mm long, slightly thick, glabrous; calyx 0.8–1.2 × 1–1.5 mm, lobed to below middle, glabrous, black-dotted; lobes 0.5–0.8 × 0.5 mm, broadly ovate, abruptly acuminate, ciliate; petals imbricate, elliptic or oblong, obtuse, 2–3.2 × 0.7–0.9 mm, reflexed, papillose inside, black-dotted; stamens as long as petals or slightly shorter, filaments 0.7–1.5 mm long, exserted; anthers 0.5–0.7 × 0.5–0.7 mm, ovoid-ellipsoid, emarginate or apiculate, punctate dorsally. Drupes subglobose, 6.5–9.5 × 6–9 mm, green with black flecks and spots, red or blackish purple when ripe, usually verrucose by dark raised spots, sometimes slightly ribbed when dry.

Selected specimens: Papua New Guinea. Beara, Gulf District, May 1945, *White* 13045 (BRI). Australia. Queensland. COOK DISTRICT: Tinaroo Ra. Rd, between Mareeba and Tinaroo Dam, 17°06'S, 145°35'E, May 1972, *Webb & Tracey* 11493 (BRI); S.F.R. Barron, Jan 1958, *Volck & Dansie* 1421 (BRI). NORTH KENNEDY DISTRICT: Mt Dryander near Proserpine, date unknown, *Michael* 825 (BRI). SOUTH KENNEDY DISTRICT: Dalrymple Heights and vicinity, Jul–Nov 1947, *Clemens* s.n. (BRI). WIDE BAY DISTRICT: Kin Kin, Mar 1916, *White & Francis* s.n. (BRI). MORETON DISTRICT: SE side of Mt French, Aug 1988, *Forster* 4685 & *Bird* (BRI); Coolool beach, Apr 1978, *Jessup & Sharpe* 116 (BRI). New South Wales. Ballina, Feb 1894, *Bauerlen* 1167 (BRI).

Distribution and habitat: From Atherton Tableland, northeastern Queensland, extending to as far south as Williams R., New South Wales (Map 3), also at Beara in southern New Guinea; usually in dry rain forests or edge of rainforests.

E. australiana is easily distinguishable from other *Embelia* species in Australia, by its very small few-flowered inflorescences and large fruits.

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*The correct authors for this species should be (F. Muell.) Bailey and not (F. Muell.) Mez, as indicated in some literature. F.M. Bailey made the combination in 1900, two years before Mez.

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THE GENUS *OPHIORRHIZA* L. (RUBIACEAE) IN AUSTRALIA

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Summary

One species of *Ophiorrhiza* L. occurs in Australia viz *O. australiana*. The subspecies *O. australiana* subsp. *heterostyla* is described as new. A description of the genus and of the Australian species is given, together with notes on its habitat, distribution and conservation status.

Introduction

The genus *Ophiorrhiza* L. is distributed throughout the Indo-Malesian region and has its greatest diversity in south east Asia and New Guinea. *Ophiorrhiza* has approximately 150 species (Mabberley 1989) with one species, *O. australiana* Benth., being recorded for Australia. This species was described by Bentham (1866) from material collected from Rockingham Bay in north eastern Queensland. While I was preparing an account of *Ophiorrhiza* for the Flora of Australia it became apparent that there are two distinct taxa within the genus in Australia. The paper gives a detailed description of *O. australiana* s. str. and describes a new subspecies.

Materials and Methods

Herbarium material from BRI, K, QRS and MEL has been examined. Measurements have been taken from dried or spirit material.

Pollen was collected from herbarium specimens at BRI and prepared by the standard acetolysis method outlined by Erdtman (1969). Acetolysed grains were air dried from 100% acetone onto aluminium stubs. These samples were sputter coated with platinum and examined with a Phillips 500 scanning electron microscope.

Taxonomy

Ophiorrhiza L., Sp. Pl. 150 (1753), Gen. Pl. ed. 5: 74 (1754). Type: *O. mungos* L. (lecto, *fide* Hitchcock & Green (1929)).

Derivation of name: From the Greek *ophios* (a snake), *rhiza* (root); in reference to the long spreading serpentine roots.

Erect or ascending herbs or shrubs. Leaves opposite, mostly petiolate, chartaceous, elliptic-lanceolate or lanceolate-ovate or obovate to ovate, entire, penninerved, without domatia. Stipules interpetiolar, entire or lobed, persistent or caducous. Flowers in terminal (rarely axillary) helicoid cymes, usually united into umbelliform-corymbiform inflorescences; bracts small, setaceous to well developed leaf-like structures, or absent. Flowers isostylous or heterostylous. Perianth epigynous. Calyx 5-merous, minute. Corolla tube cylindrical, infundibuliform or suburceolate; lobes 5, valvate. Androecium 5; filaments adnate to corolla tube; anthers included or exserted. Ovary 2-celled, subglobose to obovoid, often conspicuously ribbed, crowned with 2-lobed disk; placenta fleshy attached to septum by short stalk; ovules numerous. Style included or exserted, filiform; stigma bifid, filiform, capitate or clavate. Capsule 2-celled laterally flattened, obcoronate or mitriform (rarely subglobose), mostly broader than long, dehiscent loculicidally. Seeds numerous, minute, rhomboid to obconic.

Ophiorrhiza australiana Benth., Fl. austral. 3: 407 (1866). Type: Queensland. Rockingham Bay, undated, *Dallachy* s.n. (holo: K).

Ascending to erect herbs or subshrubs to 60 (150) cm high. Stems usually not or slightly branched, densely covered when young with weak crisped, ferruginous to whitish hairs up to 1.0 mm long. Leaves chartaceous, discolourous, green above, paler beneath, narrowly elliptic to elliptic or lanceolate to narrowly ovate, 8–16 cm long, 2.5–6 cm wide, midrib flat to canaliculate above, prominent below, secondary veins 9–14 per side,

flat above, prominent below, acute or attenuate at base, acute to acuminate at apex; petiole slender, canaliculate, 1.0–4.0 cm long, densely covered with weak, crisped hairs. Stipule-sheath caducous, coriaceous, produced into 1 or 2 setae, totally 4–12 mm long. Inflorescences terminal cymes, compact, corymbiform, 3–6-branched, 1–5 cm long, 10–20 flowers per branch; peduncles 1–6 cm long, sparsely to densely covered with weak, crisped, stramineous to ferruginous hairs; bracts setaceous, up to 4 mm long. Flowers 5 (rarely 4 or 6)-merous, sessile or on short pedicels up to 1 mm long, isostylous or heterostylous. Calyx lobes triangular to deltoid, 0.7–1.5 mm long, puberulent. Corolla cream or pink, hypocrateriform; tube 2.5–4.0 mm long, pubescent outside with short erect hairs, glabrous inside except densely bearded at throat; hairs up to 1.5 mm long, with wavy lateral walls; lobes ovate, pubescent outside with short erect hairs, densely papillose inside. In isostylous flowers stamens included, filaments filiform, 0.5–1.0 mm long, adnate to corolla at 1/5 to 1/4 the length of corolla tube, anthers linear, c. 1.0 mm long; style filiform, 1.0–1.7 mm long; stigma bifid; lobes c. 0.5 mm long. In heterostylous short-styled flowers stamens exserted, filaments filiform, 2.5–3.5 mm long, adnate to corolla at 1/4 to 1/2 the length of corolla tube; anthers linear, c. 1.5 mm long; style filiform, c. 1.5 mm long; stigma bifid; lobes filiform c. 1 mm long, erect. In heterostylous long-styled flowers stamens included, filaments filiform, c. 0.5 mm long, adnate to corolla c. 1/4 the length of corolla tube; anthers linear, c. 1.5 mm long; style filiform, 4.0–5.0 mm long; stigma capitate. Ovary 2-celled, subglobose to obovoid, 1–1.5 mm diameter, ridged, capped by a 2-lobed disk which encircles base of style. Placenta fleshy, peltately attached by short stalk to septum; ovules 8–20/locule. Capsules mitriform, 2–3 mm long, 6–7 mm wide, pubescent, splitting loculicidally. Seeds irregular shaped, cubic to obconic, c. 0.5 mm along the longest axis; testa brown, faintly reticulate. **Fig. 1.**

Key to subspecies of *Ophiorrhiza australiana*

1. Flowers isostylous; indumentum on upper leaf surface composed of weak, crisped, ferruginous hairs; corolla lobes 1–2 mm long
 ***O. australiana* subsp. *australiana***
- Flowers heterostylous; indumentum on upper leaf surface composed of more or less straight, erect to appressed, whitish hairs; corolla lobes 1.5–4 mm long
 ***O. australiana* subsp. *heterostyla***

Ophiorrhiza australiana Benth. subsp. *australiana*

Young stems, peduncles and petioles densely covered with weak crisped, ferruginous hairs. Leaf lamina on both surfaces covered with scattered weak, crisped, hairs; midrib and secondary veins often purplish especially towards leaf base. Flowers isostylous; corolla lobes 1–2 mm long. **Fig. 2.**

I have examined pollen of this subspecies (**Fig. 1**) which is similar in structure to pollen of the Pacific species of *Ophiorrhiza* described by Darwin (1976). The pollen grains are 3-colporate, isopolar, radially symmetrical, spheroidal to subprolate in equatorial view with equatorial axis length 33–48 μ , subtriangular in polar view with polar axis length 32–40 μ ; colpi 22–26 μ long; ora circular, 3–5 μ in diameter; margin crassimarginate; exine surface semitectate, reticulate-perforate; collumellae numerous; lumina 0.5–1 μ in diameter.

Representative specimens: Queensland. COOK DISTRICT: Gap Creek, c. 22 miles [35 km] S by E of Cooktown, 15°4'–S, 145°1'–E, May 1969, *Smith* s.n. [AQ 339973] (BRI); end of Granite Creek logging road Bloomfield River, W of Ayton, May 1969, *Webb & Tracey* 9000 (BRI); Daintree, 16°15'S, 145°19'E, Nov 1954, *Blake* 19728 (BRI); foothills Thornton Peak, Sep 1937, *Brass & White* 269 (BRI); Mosman Intake, 16°27'S, 145°22'E, Aug 1957, *Smith* 10030 (BRI); N of Kuranda, Sep 1963, *Hyland* AFO/2817 (BRI); F.R. 1073, 16°45'S, 145°30'E, Nov 1965, *Rudder* 4047 (BRI); Yarrabah, [16°54'S, 145°52'E], Oct 1918, *Michael* 568 (BRI); Freshwater Creek, S of Redlynch, 16°59'S, 145°40'E, Oct 1973, *Webb & Tracey* 13655 (BRI, QRS); N.P.R. 226 (Harvey Creek), 17°15'S, 145°50'E, Jan 1972, *Hyland* 5784 (BRI, QRS); Weinerts Creek, Babinda, 17°20'S, 145°54'E, Nov 1982, *Jago* 557 (QRS); Wyvuri Holding, 17°20'S, 146°00'E, Dec 1972, *Hyland* 7893 (BRI, QRS); The Boulders, Babinda, 17°21'S, 145°55'E, Dec 1972, *Birch* 89 (BRI); Bartle Frere, Oct 1935, *Flecker* 845 (QRS); Tchupala Falls – Crawford's Lookout walk, 17°36'S, 145°48'E, Feb 1981, *Irvine* 2079 (QRS). NORTH KENNEDY DISTRICT: Jarra Creek, W of Tully, Nov 1951, *Smith* 4994 (BRI); near Cardwell, W of Kennedy, 18°1'–S, 145°5'–E, Sep 1938, *Blake* 9728 (BRI); upper reach of Deluge Inlet, Hinchinbrook Island, 18°24'S, 146°15'E, May 1972, *Webb & Tracey* 11187 (BRI); Exp. e/p 19, Burgoon L.A., Garrawalt, 18°30'S, 145°45'E, Jul 1975, *Sanderson* S707 (QRS); Wallaman N.P., 18°3'–S, 145°4'–E, Nov 1985, *Williams* 85324 (BRI).

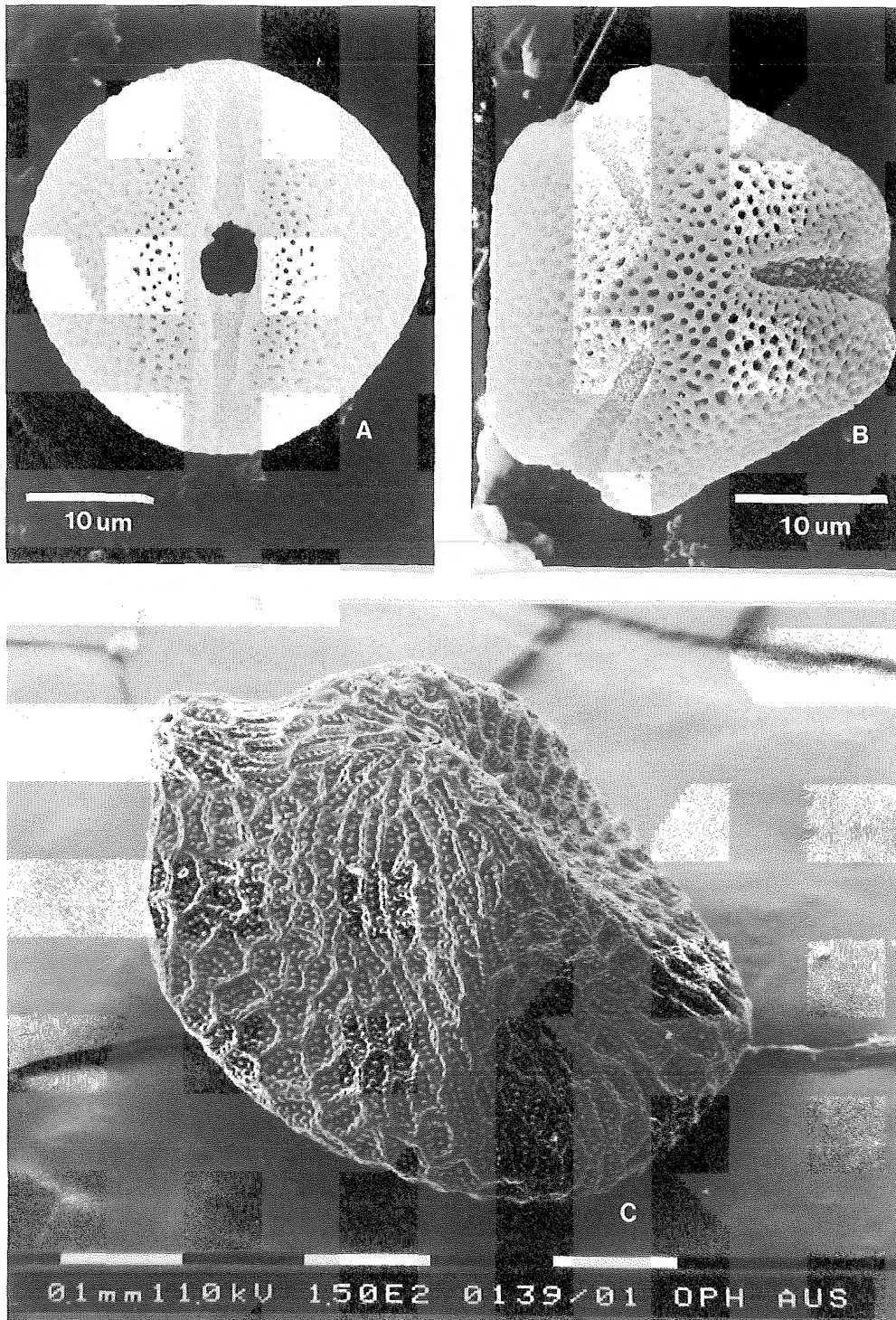


Fig. 1. Scanning electron micrographs of *Ophiorrhiza australiana* subsp. *australiana*: A,B, pollen. A, equatorial view. B, polar view. C, seed mounted with hilum viewed obliquely from the side. A,B, Webb & Tracey 13655, BRI; C, Webb & Tracey 10484.

Distribution and habitat: This subspecies is confined to the area between Cooktown and Ingham in north Queensland (Map 1) where it is found on alluvial soils of granitic origin and red loams along the banks of streams in rainforests and mesophyll vine forests in areas of good light penetration to the forest floor.

Conservation status: This subspecies is known to occur in a number of National Parks and is not considered to be rare, threatened or endangered at present.

Notes: The holotype is located at Kew. The sheet has a label in Bentham's hand 'Rockingham Bay Dallachy'. There is one specimen of this taxon in MEL (MEL 1583636) collected by Dallachy from Rockingham Bay which is dated (2nd March 1864) before the name was published. There is information on flower colour and height in Dallachy's hand which Bentham did not refer to in his protologue and there is no indication on the sheets that Bentham saw the specimen. It appears unlikely then that Bentham used this specimen in producing his protologue and therefore it is not considered to be type material. As to whether or not the MEL specimen is an isotype cannot be ascertained as there is no way of linking it to the holotype.

Ophiorrhiza australiana subsp. **heterostyla** Halford, subsp. nov. floribus heterostylibus, corollae lobis 1.5–4.0 mm longis, folii lamina supra pilis albidis ascendentibus usque appressis plus minusve strictis ornata diagnoscenda. **Typus:** Queensland. COOK DISTRICT: Massey Gorge, c. 23 km NW of Silver Plains Station, 13°50'S, 143°24'E, 9 November 1980, J.R. Clarkson 3619 (holo: BRI; iso: QRS).

Young stems, peduncles and petioles densely hairy with weak crisped whitish hairs. Leaf lamina covered with scattered, more or less straight, erect to appressed hairs, with weak, crisped, hairs on midvein, secondary veins and leaf margins; midrib and secondary veins stramineous to whitish. Flowers heterostylous; corolla lobes 1.5–4 mm long. Fig. 2.

Pollen of this subspecies has not been examined due to insufficient material available.

Representative specimens: Queensland. COOK DISTRICT: "Steelwire Bridge" East Claudie River, 12°43'S, 143°19'E, Dec 1981, Tucker 305 (QRS); Mt Tozer, near Iron Range, 12°45'S, 143°12'E, Nov 1977, Tracey 14859 (BRI, QRS); Claudie River, 12°45'S, 143°15'E, Oct 1973, Hyland 6984 (QRS); Tozer Gap, Tozer Range, Jun 1948, Brass 19374 (BRI); slopes of Iron Range (Mt Lamond), Nov 1956, Webb 3233 (BRI); Leo Creek, Upper Nesbit River, Aug 1948, Brass 19853 (BRI); T.R. 14, Leo Creek Road, 13°40'S, 143°20'E, Sep 1972, Irvine 369 (QRS); McIlwraith Range, c. 11 miles [18 km] NE by E of Coen, Oct 1962, Smith 11798 (BRI); upper reaches of Chester River on eastern fall of McIlwraith Range, 13°43'S, 143°24'E, Jul 1978, Clarkson 2430 (BRI); T.R. 14 (McIlwraith Range – Leo Creek road), 13°45'S, 143°20'E, Sep 1975, Hyland 8439 (QRS); Massey Gorge, on eastern fall of McIlwraith Range, 13°49'S, 143°23'E, Sep 1979, Clarkson 2633 (BRI, QRS); McIlwraith Range, 13°50'S, 143°15'E, Sep 1974, Hyland 7625 (QRS); headwaters of Massey Creek near old mining site, McIlwraith Range, c. 13°50'S, 143°20'E, Oct 1969, Webb & Tracey 9101 (BRI); Rocky River near E boundary of T.R. 14, 13°50'S, 143°25'E, Sep 1973, Dockrill 713 (QRS); headwaters of Lankelly Creek on western fall of McIlwraith Range, c. 13°52'S, 143°20'E, Oct 1969, Webb & Tracey 9553 (BRI); SE slopes of McIlwraith Range, c. 13°55'S, 143°15'E, Aug 1966, Curtis 365 (BRI).

Distribution and habitat: This subspecies is confined to the Iron and McIlwraith Ranges on Cape York Peninsula (Map 1) where it is found on soils derived from granitic and metamorphic rocks along banks of creeks in sclerophyll, mesophyll and notophyll vine forest in areas of good light penetration to the forest floor.

Conservation status: Although this subspecies is found only in the forests of two mountain ranges on Cape York Peninsula, it is not considered to be rare, threatened or endangered at present. It is known to occur in the Iron Range National Park.

Notes: Heterostyly has been reported in numerous genera in the Rubiaceae (Verdcourt 1958). There has been differing views, however, as to whether or not heterostyly occurs in *Ophiorrhiza*. Schumann (1891) considered it to be well developed in the genus while more recently Verdcourt (1958) reported it as being absent. Backer and Bakhuizen Van den Brink (1965) record that *O. canescens* Blume and *O. marginata* Blume are heterostylous. Vuilleumier (1967) did not record heterostyly in *Ophiorrhiza* in her survey of heterostyly in the Angiosperms. Darwin's (1976) revision of the Pacific species of *Ophiorrhiza* produced no evidence of heterostyly although he reported the variable location of the stamens in *O. leptantha*. However as he points out, this is not heterostyly in the true sense as the positions of the stigma and anthers are not exactly reversed from flower to flower. It is clear from the Australian material of *Ophiorrhiza* that heterostyly does occur in the genus.

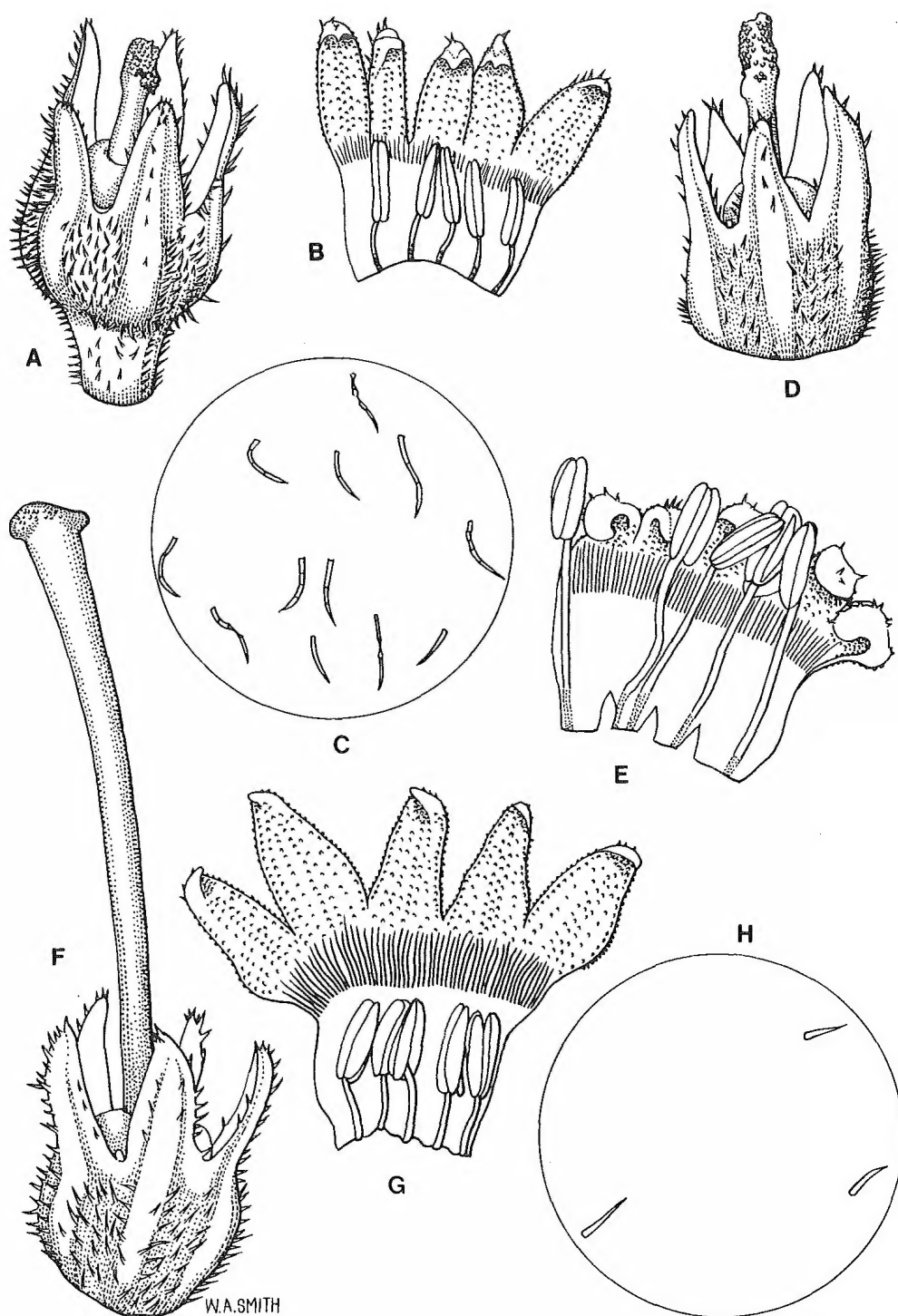
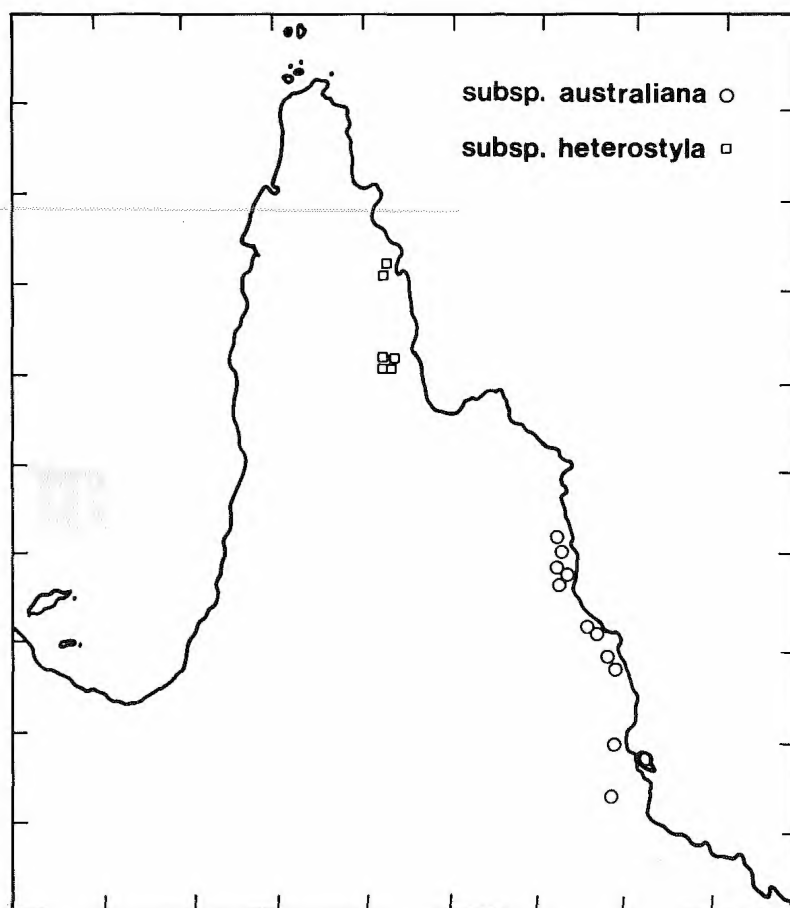


Fig. 2. *Ophiorrhiza australiana* subsp. *australiana*: A. ovary, calyx lobes and style $\times 18$. B. corolla opened out $\times 9$. C. portion of upper leaf surface $\times 18$. *O. australiana* subsp. *heterostyla*: D,E, short styled flower; D. ovary, calyx lobes and style $\times 18$. E. corolla opened out $\times 9$. F,G, long styled flower. F. ovary, calyx lobes and style $\times 18$. G. corolla opened out $\times 9$. H. portion of upper leaf surface $\times 18$. A,B, Michael 568; C, Thorsborne 423; D,E,H, Clarkson 3619; F,G, Webb & Tracey 9101.



Map 1. Distribution of subspecies of *Ophiorrhiza australiana*.

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REVISION OF THE *RHODOMYRTUS TRINEURA* (F. MUELL.) F. MUELL. EX BENTH. (MYRTACEAE) SPECIES COMPLEX

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Summary

The *Rhodomyrtus trineura* species complex is revised. *R. novoguineensis*, *R. canescens* and *R. sericea* are reinstated as species distinct from *R. trineura*. *R. pervagata*, *R. trineura* subsp. *capensis* and *R. effusa* from Australia and *R. lanata* and *R. montana* from New Guinea are described as new. A key to the species is provided and the new species illustrated.

Introduction

Scott (1978) recognised four varieties of *Rhodomyrtus trineura* (F. Muell.) F. Muell. ex Benth., viz var. *trineura*, var. *novoguineensis* (Diels) A.J. Scott, var. *macrophylla* Domin, and var. *canescens* (C. White & Francis) A.J. Scott. The differences in the habit, habitat, leaf and floral morphology of these taxa necessitates their elevation to specific rank. *Rhodomyrtus sericea* Burret, included within *R. trineura* var. *trineura* by Scott (1978), is also specifically distinct. In addition, two allied species from New Guinea need formal description. Both are described from material included by Scott under *R. trineura* var. *novoguineensis*.

Floral and fruit measurements given are based on material preserved in spirit or reconstituted material.

Key to *Rhodomyrtus trineura* and Related Species

1. Ovules/seeds in 16-22 rows; fruits ellipsoidal 2
Ovules/seeds in 3-12 rows; fruits globular or subglobular 3
2. Abaxial leaf surface villous, hairs dense; pedicels to 2 mm long.
NE New Guinea 7. *R. lanata*
Abaxial leaf surface pubescent, hairs mid-dense; pedicels 2-5 mm long.
New Guinea 6. *R. novoguineensis*
3. Inflorescences monads, rarely triads; tomentum of branchlets and leaves
erect or erect as well as appressed 4
Inflorescences triads and monads; tomentum of branchlets and leaves
appressed. NE Australia 3. *R. canescens*
4. Pedicels 5-14 mm long 5
Pedicels to 5 mm long 6
5. Ovules/seeds in 3-5 rows. NE Australia 1. *R. trineura*
Ovules/seeds in 7-10 rows. NE Australia 4. *R. pervagata*
6. Leaves 1.5-3.8 cm wide; small trees or shrubs 7
Leaves 4-8.5 cm wide; straggling shrubs. NE Australia 5. *R. effusa*
7. Leaves sericeous or pubescent below; inflorescences 2 per axil 8
Leaves ferruginous-villous below; inflorescences 1 per axil. West
Irian 8. *R. montana*
8. Leaves pubescent below, hairs erect, mid-dense; ovules/seeds in 3-5 rows.
NE Australia 1. *R. trineura*
Leaves sericeous below, hairs erect and appressed, dense; ovules/seeds in
6-9 rows. NE Australia 2. *R. sericea*

1. **Rhodomyrtus trineura** (F. Muell.) F. Muell. ex Benth., Fl. austral. 3: 272 (1866). *Myrtus trineura* F. Muell., Fragm. 4: 177 (1864). **Type:** Peak Range, Rockingham Bay, 2 March 1864, J. Dallachy 1 (lecto (designated here): MEL).

Spreading shrub to 1–3(–5) m; bark smooth, brown. Branchlets and young leaves ferruginous pubescent with erect hairs 0.3–0.9 mm long. Lamina ovate or ovate-lanceolate, 5–12 cm long, 1.5–3.7 cm wide, glabrous above except for hairs along midvein, pubescent below with mid-dense erect hairs 0.5–1 mm long, 3-veined above the base, apex acuminate or acute; base attenuate; venation raised below, midrib sunken above; primary marginal veins 4–6 mm from base, 2–4 mm from margin; oil glands distinct, sparse to mid-dense. Petiole pubescent, 3–6(–9) mm long. Inflorescences 2 per axil, monads, 10–16 mm long; pedicels pubescent, 2–10 mm long; pherophylls and metaxyphylls lanceolate, pubescent, deciduous, 2–3 mm long. Flowers 5-merous; perigynium pubescent, 2.8–3.3 mm long and 3.3–3.6 mm diameter at anthesis. Calyx lobes ovate, acute, pubescent, 2.5–3 mm long, 2.2–2.5 mm wide. Petals white or pinkish, obovate, pubescent or villous outside, except for glabrous margins, glabrous inside, 5.6–7 mm long, 4.6–6 mm wide. Stamens 125–134, $\pm$ in 4 whorls; filaments 3–3.5 mm long; anthers 0.6–0.7 mm long. Ovary 3-locular, summit puberulent; ovules 6–10 per loculus in 2 series of 3–5 on axile placentas; style puberulent at base, glabrous above, 4–5 mm long; stigma capitate, 0.5–0.6 mm diameter. Fruit cream, globular, pubescent, crowned by persistent calyx lobes, 10–12 mm long, 10–12 mm diameter. Seeds 18–30, reniform, flattened, 1.4–1.7 mm long.

Two subspecies are recognised.

1a. *R. trineura* subsp. *trineura*

Petals pubescent; pedicels 2–6 mm long.

Selected specimens: Queensland. NORTH KENNEDY DISTRICT: Mt Koolmoon Forest Reserve, about 7 miles [11.7 km] S of Ravenshoe, Aug 1963, *Schodde* 3292 (BRI); Mission Beach, 17°55'S, 156°05'E, Nov 1963, *Hyland* 03086 (BRI); Hobans Creek on Mission Beach Road 4 miles [6.4 km] from Tully, Jun 1970, *Moriarty* 276 (BRI); Dunk Island on hill behind Brammo Bay, 18°55'S, 146°09'E, Nov 1970, *Webb & Tracey* 10685 (BRI); Mount Kootaloo, Dunk Island, 17°57'S, 146°10'E, Nov 1985, *Sharpe* 4237 (BRI); S.F. 702, south bank of Murray River near mouth, 18°05'S, 146°01'E, Oct 1975, *Thorsborne* 116 (BRI); Kirrama, 19°07'S, 145°37'E, Jul 1947, *Smith* 3194 (BRI); Cardwell forestry area, Aug 1980, *Williams* 80156 (BRI); Five Mile Creek near Cardwell upstream from Highway, Aug 1979, *Byrnes* 3925 (BRI); Gould Island, Rockingham Bay, Aug 1865, *Dallachy* [AQ 278670] (BRI); Agnes Island, close to Hinchinbrook Island, 18°20'S, 146°19'E, Aug 1975, *Sharpe* 1762 (BRI); upper reaches of North Zoe Creek, Hinchinbrook Island, 18°21'S, 146°16'E, Jul 1988, *Fell* 1162 (BRI); W of Ingham, near Wallaman Falls, Aug 1951, *Blake* 18806 (BRI); near Witts Lookout, Mt Spec National Park, Mar 1988, *Fell* 674 (BRI); about 4 km W of Paluma, 19°01'S, 146°10'E, Jan 1986, *Guymer* 2011 (BRI). SOUTH KENNEDY DISTRICT: Dalrymple Heights and vicinity, Aug 1947, *Clemens* [AQ 045226] (BRI,L); Cape Hillsborough, 20°55'S, 149°02'E, Dec 1987, *Thomson* 126 (BRI). PORT CURTIS DISTRICT: Shoalwater Bay Military Reserve, CSIRO ISOPOD site, c. 2.5 km N of Mt Parnassus, 22°48'S, 150°35'E, Jul 1977, *Clarkson & Stanley* 672 (BRI); Water Park Creek, 3.5 km NE of Byfield, Livingstone Shire, 22°49'S, 150°39'E, Aug 1985, *Anderson* 4010 (BRI); Byfield near Keppel Bay, Sep 1931, *White* 8016 (BRI).

Distribution and habitat: This subspecies is found from Ravenshoe to Byfield, Queensland and occurs on the margins of notophyll vine forest, along creeks and occasionally in open forests at altitudes from near sea-level to 800 m.

- 1b. *R. trineura* subsp. *capensis* Guymer, subsp. nov.** differt ab subsp. *trineurae* petalis villosis et pedicellis longioribus (3–10 mm longis). **Typus:** Queensland. COOK DISTRICT, McIlwraith Ra., T.R. 14, Leo Creek road, 13°45'S, 143°20'E, September 1975, *B. Hyland* 8383 (holo: BRI; iso: BRI, QRS distribuendi).

Distinguished from *R. trineura* subsp. *trineura* by the villous petals and longer pedicels (3–10 mm long).

Specimens examined: Australia. Queensland. COOK DISTRICT: Iron Range, Jun 1948, *Brass* 19333 (BRI,L); Mt Tozer near Iron Range, 12°45'S, 143°12'E, Nov 1977, *Tracey* 14851 (BRI, QRS); Hill E of Mt Tozer, Iron Range area, 12°45'S, 143°13'E, Nov 1977, *Tracey* 14203 (BRI, QRS); Claudie River, 12°45'S, 143°15'E, Sep 1976, *Hyland* 9029 (BRI,L, QRS); ditto, Oct 1974, *Hyland* 7806 (BRI,L, QRS); ditto, Oct 1973, *Irvine* 671 (BRI, QRS); Mt Carter, 13°00'S, 143°15'E, Sep 1974, *Hyland* 7554 (BRI,L, QRS); T.R. 14, McIlwraith Range, Leo Ck road, 13°45'S, 143°20'E, Sep 1975, *Hyland* 8383 (BRI, QRS); ditto, *Hyland* 8390 (BRI, QRS); McIlwraith Range, 13°50'S, 143°15'E, Sep 1974, *Hyland* 7645 (BRI,L, QRS); Headwaters of Massy Ck near old mining site, McIlwraith Range, 13°50'S, 143°20'E, Oct 1969, *Webb & Tracey* 9129 (BRI); Headwaters of Lankelly Creek on western fall of McIlwraith Range, 13°52'S, 143°20'E, Oct 1969, *Webb & Tracey* 9531 (BRI); Lankelly Creek on western fall of McIlwraith Range, 13°55'S, 143°15'E, Oct 1969, *Webb & Tracey* 9637 (BRI).

Distribution and habitat: This subspecies is found from Iron Range to McIlwraith Range, Cape York Peninsula, Queensland and occurs on the margins of mesophyll or notophyll vine forest at altitudes of 20 to 600 m.

Phenology: This species flowers from August to January with occasional records for May. Fruiting specimens have been collected in June, October to January, and March and May.

Notes: *R. trineura* is distinguished from other species in this complex by its spreading shrubby habit, mid-dense leaf tomentum and ovules/seeds in 3 to 5 rows.

There are two specimens of Dallachy's in MEL which were collected before Mueller's publication of this species. The Dallachy specimen collected on 26 January 1864 has smaller leaves than that given by Mueller, whereas the specimen collected on 2 March 1864 agrees with Mueller's protologue. Hence this latter specimen has been selected as the lectotype of *R. trineura*.

2. *Rhodomyrtus sericea* Burret, Notizbl. Bot. Gart. Berlin 15: 497 (1941). Type: Australia, Queensland. COOK DISTRICT, Mt Bellenden-Ker, *W. Sayer* s.n. (holo: B†; iso: MEL).

Shrubs or small trees, 2–6(–8) m tall, d.b.h. to 10 cm; bark smooth, reddish brown to dark brown. Branchlets and young leaves sericeous with erect and appressed silken brown hairs 0.2–1 mm long. Lamina elliptic to lanceolate, (3–)4–9 cm long, 1.4–1.7 cm wide, glabrous above except for hairs along primary veins, sericeous or velutinous below with dense erect and $\pm$ appressed hairs 0.2–0.5 mm long, 3-veined above the base, apex acuminate, base cuneate or attenuate, often decurrent with petiole; margins recurved; venation raised below, midvein sunken above; primary marginal veins 3–7 mm from base, 1–2 mm from margin; oil glands distinct, moderately dense. Petiole pubescent, 5–9 mm long. Inflorescences 2 per axil, monads, rarely triads, 12–20 mm long; pherophylls and metaxyphylls pubescent, lanceolate, acute, 2–2.5 mm long. Flowers 5-merous; perigynium pubescent, 2.5–3.4 mm long, 2.8–3.5 mm diameter at anthesis. Calyx lobes rounded or semi-circular, pubescent, 2–2.6 mm long, 2.4–3.1 mm wide. Petals white, obovate, puberulent outside except for the margins, glabrous inside, 6–8 mm long, 4.5–6 mm wide. Stamens 130–144, $\pm$ in 4 whorls; filaments 4.8–5.5 mm long; anthers with 3–5 oil glands along connective, 0.6–0.7 mm long. Ovary 3-locular, summit puberulent; ovules 12–18 per loculus in 2 series of 6 to 9, on axile placentas; style pubescent at base, glabrous above, 5–6 mm long; stigma capitate, 0.5–0.65 mm diameter. Fruits cream or pale brown, globular, pubescent, crowned by persistent calyx lobes, 12–13.5 mm long, 10–11 mm diameter. Seeds 36–54, reniform, flattened, 1.6–1.8 mm long.

Selected specimens: Australia, Queensland. COOK DISTRICT: Mt Finnegan, Sep 1943, *Brass* 20134 (BRI); summit of Mt Finnegan, 15°47'S, 145°17'E, Aug 1972, *Webb & Tracey* 10839 (BRI); N.P.R. 164, Thornton Peak, 16°10'S, 145°20'E, Nov 1973, *Hyland* 7058 (BRI); Thornton Peak, Mar 1932, *Brass* 2297 (BRI); V.C.L. Noah, Mt Hemmant, 16°10'S, 145°25'E, Oct 1975, *Hyland* 8488 (BRI); Mt Spurgeon, 16°26'S, 145°12'E, Sep 1936, *White* 10606 (BRI); 21 km along Mt Lewis Rd, Jan 1986, *Guymer* 2020 (BRI); summit of Mt Demi, 16°30'S, 145°19'E, Feb 1932, *Brass* 2098 (BRI); Mt Windsor, Mar 1941, *Carr* 13a (BRI); S.F.R. 143, Leichhardt L.A., 16°36'S, 145°17'E, Dec 1981, *Hyland* 11423 (BRI); Mt Lewis, 16°3–S, 145°1–E, Oct 1982, *Williams* 82198 (BRI); ditto, *Williams* 82204 (BRI); end of Mt Lewis Rd, 16°35'S, 145°15'E, Aug 1957, *Smith* 10086 (BRI); Bellenden Ker Range, 17°15'S, 145°50'E, Oct 1974, *Hyland* 7767 (BRI); Centre peak near TV tower, summit of Bellenden Ker, Nov 1972, *Webb & Tracey* 10804 (BRI); Mt Bellenden Ker near the cableway terminus, Sep 1986, *Clarkson* 6572 (BRI); Bellenden Ker, Jan 1923, *White* s.n. (BRI); Mt Bellenden Ker, c. 0.5 miles [0.8 km] SW of centre peak, Jun 1969, *Smith* 14633 (BRI); Mt Bartle Frere, Oct 1929, *Kajewski* 1282 (BRI); Bartle Frere, summit of south peak, Jun 1961, *Martin & Hyland* 1894 (BRI); Bartle Frere, 4,200 ft to summit, Oct 1967, *Scarth-Johnson* s.n. (BRI).

Distribution and habitat: *R. sericea* is endemic in NE Queensland from Mt Finnegan to Mt Bartle Frere at altitudes of 900–1650 m. It occurs on the margins of microphyll-notophyll vine-fern forests, in windswept microphyll mossy thickets and in wet sclerophyll forest adjoining these vine forest types. It grows on a variety of soil types derived mainly from granite.

Phenology: This species flowers from August to December and fruits from December to June.

Notes: *R. sericea* is distinguished from *R. trineura* by its sericeous leaves and ovules/seeds in 6 to 9 rows.

3. *Rhodomyrtus canescens* C. White & Francis, Queensland Dept. of Agric. Bot. Bull. 22: 26 (1920); *Rhodomyrtus trineura* var. *canescens* (C. White & Francis) A.J. Scott, Kew Bull. 33: 325 (1978). **Type:** Australia, Queensland, COOK DISTRICT, Atherton, January 1918, *C.T. White* [AQ 278660] (holo: BRI; iso: K).

Shrubs 1.5–4 m tall, bark smooth, grey. Branchlets and young leaves puberulent with appressed simple hairs 0.1–0.3 mm long. Lamina lanceolate or elliptic, 4.5–10(–12) cm long, 1.5–3(–3.5) cm wide, glabrous or with occasional scattered appressed hairs above, canescent below (hairs appressed 0.1–0.25 mm long), 3-veined above the base; apex acuminate; base attenuate or cuneate; venation slightly raised above except for sunken midrib, raised below; primary marginal veins 4–10 mm from base, 1.5–3 mm from margin; oil glands distinct, moderately dense. Petiole canescent, 5–8 mm long. Inflorescence 1 per axil, metaxxytriads, 15–35 mm long; pedicels canescent, (3–)4–10 mm long; perophylls and metaxxyphylls ovate, acute, caducous, canescent, 2–3.2 mm long. Flowers 5-merous; perigynium canescent, 2.8–3.3 mm long, 3–3.5 mm diameter at anthesis. Calyx lobes rounded or semi-circular, canescent, 2–2.6 mm long, 2.1–4 mm wide. Petals white, obovate, glabrous or canescent outside with glabrous margins, 8–10 mm long, 6.5–7.5 mm wide. Stamens 165–176, $\pm$ in 4 whorls; filaments 4–5 mm long; anthers 0.5–0.65 mm long. Ovary 3-locular, summit puberulent; ovules 14–16 per loculus, in 2 series of 7 or 8, on axile placentas; style puberulent at base, glabrous above, 5.5–6 mm long; stigma capitate, 0.6–0.7 mm diameter. Fruits pale cream, globular, puberulent, crowned by persistent calyx lobes, 6.6–11 mm long, 4.5–7.1 mm diameter. Seeds 42–48, reniform, flattened, finely sculptured, 1.6–2 mm long.

Selected specimens: Australia, Queensland. COOK DISTRICT: Davies Creek, Lamb Range, Oct 1967, *Brass* 33723 (BRI); Davies Creek L.A., 17°04'S, 145°36'E, Mar 1988, *Forster* PIF 3869 & *Liddle* (BRI); S.F.R. 185, c. 5 km N of Tinaroo Falls Dam, 17°05'S, 145°36'E, Mar 1976, *Moriarty* 1984 (BRI); Noel L.A. Tinaroo Range, 17°07'S, 145°33'E, Nov 1981, *Kanis* 2149 (BRI); Tinaroo Range, on road from Downfall Creek, Feb 1962, *Webb & Tracey* 5759 (BRI); S.F.R. 194 Western, 17°16'S, 145°25'E, Feb 1981, *Gray* 1902 (BRI); Herberton Range S.F., W of Atherton, 17°17'S, 145°26'E, Jan 1986, *Guymer* 2028 (BRI); S.F.R. 194, c. 6 km WSW of Atherton, 17°17'S, 145°26'E, Mar 1976, *Moriarty* 1974 (BRI, NSW); S.F.R. 194, Barron, 17°17'S, 145°31'E, Jan 1972, *Irvine* 143 (BRI); S.F.R. 194, Western, 17°19'S, 145°26'E, Feb 1982, *Gray* 2458 (BRI); S.F.R. 99, Western, Dec 1956, *Volck* QF57/108 (BRI); Evelyn Scrub, New Crater Rd, 17°25'S, 145°30'E, undated, *Hamilton brothers* [AQ 45077] (BRI); S.F.R. 194, Hugh Nelson Ra., 17°27'S, 145°29'E, Nov 1981, *Gray* 2292 (BRI); Microwave Tower Rd near The Crater, 17°28'S, 145°29'E, Oct 1986, *G. Sankowsky* 575 & *N. Sankowsky* (BRI); c. 13 km SW of Atherton on ranges near Moomin, Sep 1950, *Smith* 4664 (BRI); R99, compartment 50, Nov 1958, *Smith* 10437a (BRI). NORTH KENNEDY DISTRICT: Herberton-Ravenshoe Rd, 1972, *Althofer* 313 (BRI); c. 13 km N of Ravenshoe, *Smith* 5039 (BRI); Ravenshoe, Apr 1945, *Flecker* 9196 (BRI); Glendinning Rd, Ravenshoe, Aug 1967, *Barnes* s.n. (BRI).

Distribution and habitat: This species is endemic in north east Queensland from the Lamb Range to Ravenshoe at altitudes of 750 to 1200 m. It occurs in or on the margins of simple or complex notophyll vine forests.

Phenology: This species flowers from late September to December and fruits from December to April.

Notes: *R. canescens* is readily distinguished from other species within the *R. trineura* group by its pedunculate inflorescences (metaxxytriads) and fine appressed indumentum.

4. *Rhodomyrtus pervagata* Guymer, sp. nov. affinis *R. trineurae* (F. Muell.) F. Muell. ex Benth. sed foliis majoribus (7–18 $\times$ 2.3–7 cm), pedicellis longioribus (5–14 mm longis) et habitu arboreo differt. **Typus:** Australia, Queensland, COOK DISTRICT, 15 km along Mt Lewis Rd, off Julatten – Mareeba Rd (16°34'S, 145°16'E), January 1986, *G.P. Guymer* 2017 (holo: BRI; iso: BRI, CANB, K, L, MEL, MO, NE, NSW, QRS distribuendi).

Rhodomyrtus trineura var. *macrophylla* Domin, Biblioth. Bot. 22: 474 (1928). **Type:** Lake Eacham, February 1910, *Domin* 7310 (lecto (designated here): PR).

Small trees 3–8(–10) m tall, d.b.h. 6–14 cm; bark smooth, grey or dark brown. Branchlets and young leaves densely pubescent with erect ferruginous simple hairs 0.2–0.6 mm long. Lamina elliptic to lanceolate, occasionally ovate, 7–14.6(–18) cm long, 2.3–5.5(–7) cm wide, glabrous above except for hairs along primary veins, pubescent below with mid-dense erect simple hairs 0.2–0.6 mm long, 3-veined above the base, apex long-acuminate; base attenuate to cuneate; venation raised below, primary veins sunken above; primary marginal veins 3–9 mm from base, 2–6 mm from margin; oil glands distinct, moderately dense. Petiole pubescent, 5–13 mm long. Inflorescences 2 or 3 per axil, monads, rarely metaxxytriads, 12–18 mm long; pedicels ferruginous-pubescent, 5–14 mm

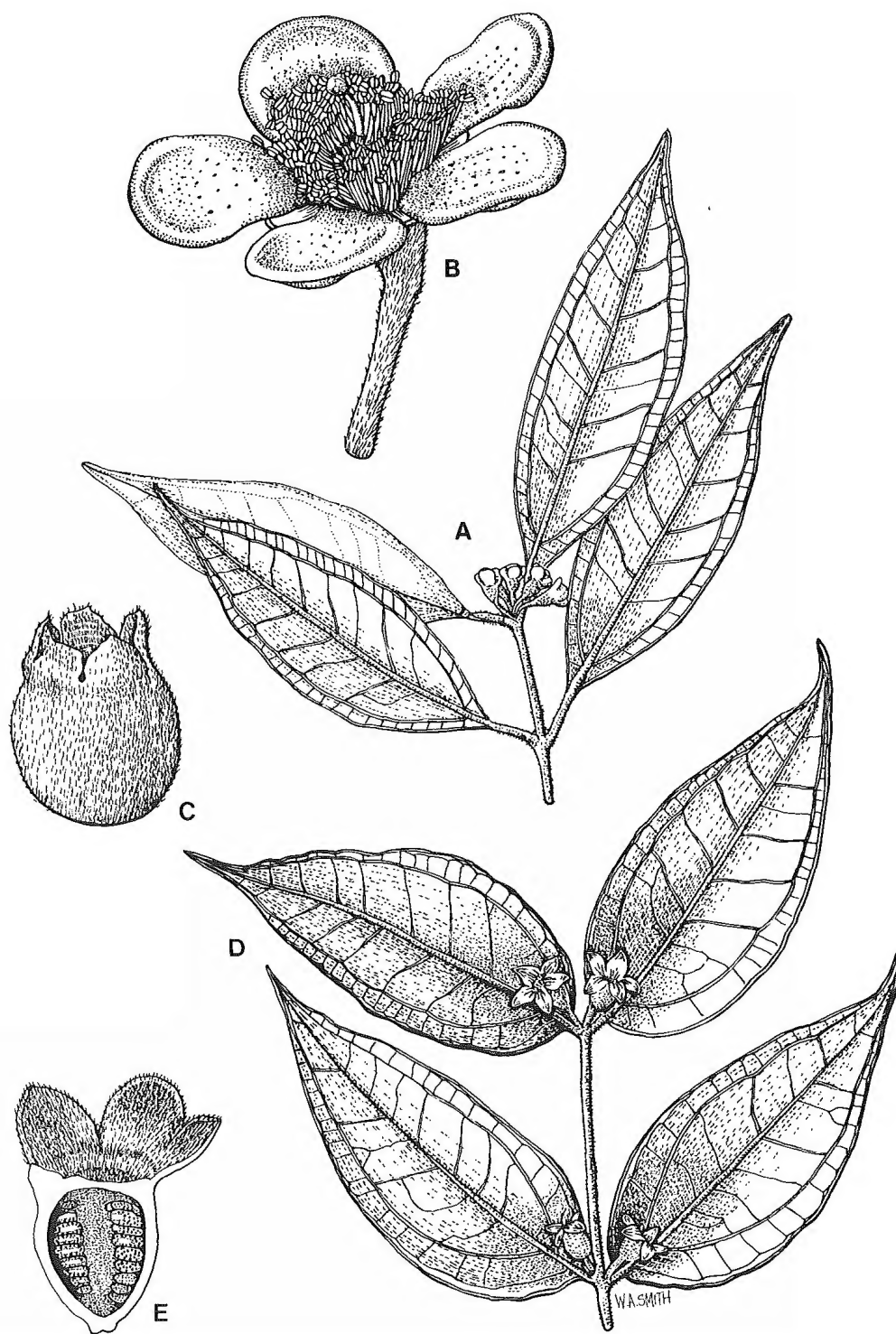


Fig. 1. *Rhodomyrtus pervagata*: A, flowering branchlets $\times 0.5$. B, flower $\times 3$. C, fruit $\times 2$. *Rhodomyrtus effusa*: D, fruiting branchlets $\times 0.67$. E, L.S. of fruit $\times 3$. A–C Guymer 2017; D,E, Guymer 2059.

long; perophylls and metaxyphylls lanceolate to ovate, pubescent, deciduous, 2.8–5.1 mm long. Flowers 5-merous; perigynium ferruginous-pubescent, 2.5–3.2 mm long and 3.2–3.6 mm diameter at anthesis. Calyx lobes rounded or semi-circular, ferruginous-pubescent outside, sericeous inside, 2.7–3.1 mm long, 3–3.5 mm wide. Petals white, cream or pale pink, obovate, sericeous outside, glabrous around the margins, glabrous inside, 8–10 mm long, 5–6 mm wide. Stamens 160–180, $\pm$ in 4 whorls; filaments cream or pink, 4.5–6 mm long; anthers with 2–5 oil glands along connective, 0.6–0.8 mm long. Ovary 3-locular, summit puberulent; ovules 14–20 per loculus, in 2 series of 7–10, on axile placentas; style puberulent at base, glabrous above, 6.5–8 mm long; stigma capitate, 0.5–0.7 mm diameter. Fruit cream when mature, globular to doliform, puberulent, crowned by persistent calyx lobes, 12–18 mm long, 10–13 mm diameter. Seeds 42–60, reniform, flattened, finely sculptured, 1.9–2.2 mm long. **Fig. 1 A–C.**

Selected specimens: Australia. Queensland. COOK DISTRICT: S.F.R. 144, Fantail L.A., Mt Windsor Tableland, 16°12'S, 145°05'E, Mar 1981, *Unwin* 762 (QRS); 15 km along Mt Lewis rd, 16°34'S, 145°16'E, Jan 1986, *Guymer* 2017 (BRI,CANB,K,L,MEL,MO,NSW); Barron Falls track, 16°51'S, 145°39'E, Jan 1986, *Guymer* 2056 (BRI,QRS); Davies Ck, 16°55'S, 145°32'E, Jan 1962, *Webb* 5558 & *Tracey* (BRI,K); 17°00'S, 145°35'E, Jan 1972, *Hyland* 5770 (BRI,K,QRS); Copper Lode Falls Dam area, Cairns, 17°00'S, 145°40'E, Dec 1972, *Birch* 32 (BRI); S.F.R. 185, c. 5 km N of Tinaroo Falls Dam, 17°05'S, 145°36'E, Apr 1976, *Moriarty* 1978 (BRI,QRS); S.F.R. 185, Haig L.A., 17°05'S, 145°36'E, Jul 1976, *Moriarty* 2136 (BRI,QRS,L); S.F.R. 185, Emerald LA, 17°06'S, 145°35'E, May 1971, *Dockrill* 86 (BRI,K,L,NSW,QRS); Tree Ck, a tributary of Mulgrave River, 17°10'S, 145°50'E, Feb 1929, *Tarden* s.n. (BRI); Lake Eacham, Feb 1910, *Domin* 7310, 7311, 7312, 7313 (all PR); Herberton Ra., 17°19'S, 145°26'E, Jan 1986, *Guymer* 2027 (BRI,CBG,NE); 2.5 km along Boonjee rd, E of Lamin's Hill, 17°22'S, 145°44'E, Jan 1986, *Guymer* 2065 (BRI); S.F.R. 310, Swipers L.A., 17°22'S, 145°44'E, Jan 1986, *Guymer* 2065 (BRI); Reserve 404, Dirran-Elinjaa Falls, 17°28'S, 145°39'E, Mar 1982, *Hyland* 11710 (BRI,QRS); S.F.R. 650, Mt Fisher, E/P 29, 17°33'S, 145°33'E, Nov 1975, *Sanderson* 799 (BRI,L,QRS); S.F.R. 756, West Charappa L.A., 17°42'S, 145°40'E, Jul 1979, *Stocker* 1737 (QRS); S.F.R. 605, Luff L.A., 17°58'S, 145°36'E, Feb 1982, *Hyland* 11703 (BRI,QRS); c. 1 km E of Paluma, 19°00'S, 146°14'E, Jan 1986, *Guymer* 2013 (BRI,CANB,MEL,NSW).

Distribution and habitat: *Rhodomertus pervagata* is endemic in north-east Queensland from Mt Windsor Tableland (16°12'S) to Paluma (19°S) and is found between 400 and 1250 m altitude. The species occurs in simple and complex notophyll vine forests on soils derived from granite, granodiorite or basalt.

Phenology: This species flowers from October to February, and sometimes May or June. Fruiting specimens have been collected from January to July.

Affinities: *Rhodomertus pervagata* has a leaf tomentum similar to that of *R. trineura* but is distinguished from that species by its larger leaves, longer pedicels and arborescent habit.

Etymology: Named from the Latin '*pervagata*' (common), in reference to the occurrence of this species along road verges throughout its distributional range.

5. *Rhodomertus effusa* Guymer, sp. nov. a *R. novoguineensi* Diels nervis lateralibus foliorum paucioribus (4–7), ovulis paucioribus (60–72), bacca subglobosa, foliis latoribus (4–8.5 cm latis) et statura minore differt. **Typus:** Queensland, COOK DISTRICT, c. 2 km along Whyanbeel-Daintree track, from Whyanbeel Ck (16°22'S, 145°20'E), January 1986, *G.P. Guymer* 2059 (holo: BRI; iso: BRI,CANB, K,L,MEL,MO,NSW distribuendi).

Straggling shrubs to 4 m tall; bark smooth grey or brown. Branchlets and young leaves ferruginous-villous with simple hairs 0.5–1.2 mm long. Lamina ovate to ovate-lanceolate, 8–18 cm long, 4–8.5 cm wide, glabrous above or pubescent along primary veins above, pubescent below with ferruginous erect simple hairs 0.3–1.5 mm long, hairs dense along veins, sparse elsewhere, 3-veined twice above the base; apex acuminate to caudate; base cordate to truncate; venation raised below, primary and secondary sunken above, distinct; primary marginal veins (lowermost pair): 1–3 mm from base, 1–4(–7) mm from margin, (uppermost pair): 3–10(–12) mm from base, (2–)4–14(–18) mm margin; lateral veins 4–7 pairs; oil glands obscure, moderately dense to sparse. Petiole pubescent, 2–5 mm long. Inflorescence 1 or 2 per axil, monads, 12–16 mm long; pedicels ferruginous-villous, 3–6 mm long; prophylls ovate to broadly ovate, ferruginous-villous, deciduous, 2.5–4 mm long, 2–3 mm wide. Flowers 5-merous; perigynium ferruginous-villous, 3–3.5 mm long, and 2–3 mm diameter at anthesis. Calyx lobes broadly ovate or slightly obovate, acute or obtuse, ferruginous-villous outside, glabrous inside, caducous, 4–6 mm long, 3.5–4.5 mm wide. Stamens 203–215, $\pm$ in 4 or 5 whorls; filaments 1.5–3.5 mm long; anthers 0.5–0.7 mm long. Ovary 3-locular, summit pubescent; ovules 20–24 per loculus, in 2 series of 10–12, on axile placentas; style pubescent at base, glabrous above, 4–5 mm

long; stigma capitate 0.4–0.5 mm diameter. Fruit cream when ripe, subglobular, pubescent, crowned by persistent calyx lobes, 5–8 mm long, 5–7 mm diameter (not seen fully mature). Fig. 1 D & E.

Specimens examined. Australia. Queensland. COOK DISTRICT: Granite Ck, lower Bloomfield R., Sep 1960, *Smith* 11078 (BRI,K); c. 25 km NNW of Daintree, Nov 1967, *Boyland* 417 (BRI,K); Height of Alexandra, c. 7 1/4 miles [12 km] NE of Daintree, Oct 1962, *Smith* 11503 (BRI,K); N bank of Daintree, R., Feb 1932, *Brass* 2212 (BRI); ditto, Dec 1929, *Kajewski* 1438 (BRI,K); Stewart Ck, (16°20'S, 145°10'E), Sep 1948, *Smith* 4043 (BRI,K); T.R. 55, Whyanbeel, (16°20'S, 145°20'E), Mar 1976, *Hyland* 8687 (QRS); T.R. 55, Jul 1974, *Hyland* 7328 (BRI,QRS); ditto, *Hyland* 7348 (BRI,QRS); Exp. E/P 35, TR 55, Whyanbeel (16°22'S, 145°26'E), Jun 1977, *Sanderson* 1208 (QRS); c. 2 km along Whyanbeel-Daintree track, from Whyanbeel Ck (16°22'S, 145°20'E), Jan 1986, *Guymer* 2059 (BRI,CANB,K,L,MEL,MO,NSW).

Distribution and habitat: *Rhodomirtus effusa* is confined to northeast Queensland from the Bloomfield River to the Rex Range (16°22'S), at altitudes of 20–100 m. It occurs on the margins of complex mesophyll vine forests on soils derived from granite.

Phenology: This species flowers from October to December and fruits from January to April.

Affinities: This species has its closest affinities with *Rhodomirtus novoguineensis* but differs by its fewer ovules per loculus (20 to 24) in 10 to 12 rows, its broad ovate to ovate-lanceolate leaves with fewer lateral nerves, its subglobular berry and its smaller stature.

Notes: Specimens of this species have invariably been included under *R. trineura* var. *macrophylla* (= *R. pervagata*). They can be readily distinguished from this species by their coarser tomentum, leaf shape, smaller petals and shorter pedicels as well as the straggling habit.

Conservation status: 2RC.

Etymology: The specific epithet refers to the straggling habit.

6. *Rhodomirtus novoguineensis* Diels, Engl. Bot. Jahrb. 57: 378 (1922); *Rhodomirtus trineura* var. *novoguineensis* (Diels) A.J. Scott, Kew Bulletin 33: 324 (1978). **Type:** Nordöstliches Neu-Guinea: In den Wäldern bei Siu, 200 m ü. M., 12 April 1909, *Schlechter* s.n. [19223] (holo: B†; iso: K,L).

Small trees to 8 m tall; bark brown, flaky. Branchlets ferruginous tomentose with simple hairs 0.2–1.0 mm long. Lamina lanceolate to ovate-lanceolate, (5–)7–15 cm long, (1.8–)2–5.5 cm wide, glabrous above except for a few hairs along the primary veins, ferruginous-pubescent below with hairs 0.5–1(–1.6) mm long, 3-veined above the base; apex acuminate to almost caudate; base acute to cuneate; venation distinct, flush above except for primary veins which are slightly sunken, raised below, primary marginal veins 2–5 mm from base, 2–5 mm from margin, lateral veins 8–10 pairs; oil glands moderately dense or sparse, distinct. Petiole pubescent, 3–5 mm long. Inflorescences 2 per axil, monads, 12–16 mm long; pedicels pubescent, 2–5 mm long; prophylls ovate or ovate-lanceolate, tomentose, 2–4 mm long, 1.2–2.6 mm wide. Perigynium mostly ellipsoidal, villous, 3.4–5.5 mm long, 2.2–3.2 mm diameter at anthesis. Calyx lobes, semicircular to broadly ovate, villous, persistent, 2.2–3 mm long, 1.5–2.4 mm wide. Petals 4 or 5, white, broadly ovate to ovate or orbicular, ferruginous-villous outside, glabrous inside or pubescent at base only, caducous, 3–4(–5) mm long, 2.5–4 mm wide. Stamens 112–130; filaments 1–1.8 mm long; anthers 0.5–0.7 mm long. Ovary 3-locular, summit pubescent; ovules 36–44 per loculus, in 2 series of 18–22 on axile placentas; style pubescent in lower half, glabrous above, 3–4 mm long; stigma capitate, c. 0.5 mm diameter. Fruit cream or pale brown, pubescent, ellipsoidal, crowned by persistent calyx lobes, 10–14 mm long, 6–9 mm diameter. Fig. 2 A & B.

Specimens examined. Papua New Guinea. BISMARCK ARCHIPELAGO: Manus Island, Kaguli Ridge, 2°05'S, 146°40'E, Oct 1974, *Foreman & Katik* LAE 59225 (BRI); Mt Dremse, 2°10'S, 146°55'E, Jun 1971, *Stone & Streimann* 10377 (BRI). WEST NEW BRITAIN PROVINCE: NNE slope of Mt Ulawon, Hoskins subdistrict, 5°02'S, 151°22'E, Feb 1971, *Lelean & Stevens* LAE 51245 (BRI,K,L). EASTERN NEW BRITAIN PROVINCE: Lower slopes of Mt Lululua, Pomio subdistrict, 5°43'S, 151°02'E, May 1973, *Steven & Lelean* LAE 58273 (BRI,K,L). WEST SEPIK PROVINCE: Prospect Creek, tributary of Frieda River, Telefomin subdistrict, 4°42'S, 141°48'E, Jun 1969, *Henty & Foreman* NGF 42614 (BRI,K,L); Carpentaria Exploration base, above Storm Ck, Dec 1977, *Hoover* 6436 (K). SEPIK PROVINCE: near Wantipi village (on Bliro R.), Aitape subdistrict, Aug 1961, *Darbyshire & Hoogland* 8365 (BRI,K,L). WESTERN HIGHLANDS PROVINCE: Shore of Lake Kapiago, Lake Kapiago subdistrict, 5°22'S, 142°33'E,

Nov 1968, *Vandenberg & Galore* NGF 42113 (BRI,K,L). MOROBE PROVINCE: Tymne – Wago track, 6°50'S, 146°42'E, Mar 1963, *Hartley* 11414 (BRI); Ekuti Divide, Bulolo – Aseki Rd, 35 km WSW of Bulolo, 7°19'S, 146°23'E, Jun 1982, *Streimann* 8375 (BRI). CENTRAL PROVINCE: Ridge SW of Efogi village, Port subdistrict, 9°10'S, 147°39'E, Sep 1973, *Foreman et al.* LAE 52473 (BRI); Mt Tafa, May-Sep 1933, *Brass* 5110 (BRI). MILNE BAY PROVINCE: Biritabu, Nov 1925, *Brass* 577 (BRI,K); N slopes of Mt Dayman, Maneau Range, Jun 1953, *Brass* 23122 (BRI); E slopes, Goodenough Island, Oct 1953, *Brass* 24491 (BRI); Junction Ugat and Mayu Rivers, near Mayu I, Raba Raba subdistrict, 9°37'S, 149°10'E, Jul 1972, *Streimann & Katik* NGF 28988 (BRI,K,L); between Agaun and Bonenau, Baniara subdistrict, 9°54'S, 149°22'E, Aug 1969, *Pullen* 7901 (BRI,K,L).

Distribution and habitat: *R. novoguineensis* occurs on the Bismarck Archipelago and mainland Papua New Guinea from near sea-level to 2400 m. It has been recorded from *Castanopsis* rainforest, *Nothofagus* dominant montane forest and open-forest.

Phenology: Flowers and fruits have been collected throughout the year.

Notes: *Hartley* 11414 is included here although it is reported to be a liana. Specimens (*Brass* 5110, *Streimann* 8375) from above 2000 m have smaller leaves ($5\text{--}8.5 \times 1.8\text{--}2.5$ cm) but in other characters agree with *R. novoguineensis*.

7. *Rhodomyrtus lanata* Guym, sp. nov. affinis *R. novoguineensi* Diels sed foliis villosis pedicellis brevioribus et petalis majoribus ($4\text{--}5.5 \times 3\text{--}4.5$ mm) differt. **Typus:** New Guinea, Edie Ck, Wau Sub-district, Morobe District, 7°45'S, 146°25'E, 14 August 1968, *Millar* NGF 12156 (holo: BRI; iso: K,L distribuendi).

Shrubs or slender trees 2–7 m tall; bark flaky, brown. Branchlets and young leaves densely ferruginous-villous with simple hairs 0.5–2.2 mm long. Lamina ovate to ovate-lanceolate, 6–13.3 cm long, 2–5.6 cm wide, tomentose above when young, glabrescent except for the primary veins, densely ferruginous-villous below (hairs 0.5–1.2 mm long), 3-veined almost from base; apex acuminate; base broadly cuneate, occasionally acute; venation distinct, sunken above, raised below, primary marginal veins 1–3 mm from base, 3–5 mm from margin; lateral veins 8–12 pairs; oil glands of medium to sparse density, readily seen with hand lens. Petiole villous, glabrescent, 3–6 mm long. Inflorescences 2 per axil, monads, 10–13 mm long; pedicels villous, to 2 mm long; prophylls ovate, obovate or ovate-lanceolate, acute, pubescent, 3–5.5 mm long, 1.4–3 mm wide. Flowers 5-merous; perigynium ovoid or ellipsoidal, villous, 4–6 mm long, 2–4 mm diameter at anthesis. Calyx lobes semicircular, or broadly ovate, villous, persistent, 2.5–3.2 mm long, 1.8–2.5 mm wide. Petals white, ovate, acute and obtuse, ferruginous-villous or sericeous outside, glabrous inside, caducous, 4–5.5 mm long, 3–4.5 mm wide. Stamens 80–82, $\pm$ in 2 or 3 whorls; filaments 2–3.3 mm long; anthers 0.4–0.5 mm long. Ovary 3-locular, summit tomentose; ovules 32–38 per loculus, in 2 series of 16–19 on axile placentas; style pubescent at base, glabrous above, 3–4 mm long; stigma capitate, 0.4–0.5 mm diameter. Fruit cream or pale brown, ellipsoidal, villous, crowned by persistent calyx lobes, 8–13 mm long, 4.5–6.5 mm diameter (not seen fully mature). **Fig. 2 E & F.**

Specimens examined: New Guinea. SEPIK PROVINCE: Puaxi Ck, Mar 1964, *Sayers* NGF 19502 (BRI,K,L). MOROBE PROVINCE: Kaindi, May 1959, *Brass* 29576 (K); Ogeramngang, Feb 1937, *Clemens* 5452A (BRI); above Edie Ck, July 1977, *Conn* 328 *et al.* (K,L); near Haumga, Aseki Patrol Area, Apr 1966, *Craven & Schodde* 1108 (BRI,K,L); headwaters of Longimar R., Aseki Patrol Area, Apr 1966, *Craven & Schodde* 1311 (BRI,K,L); Edie Ck., c. 4 miles [6 km] SW of Wau, Apr 1963, *Hartley* 11674 (BRI,K); ditto, Jan 1964, *Sayers & Hartley* 12609 (BRI); Wau-Edie Ck rd, above Golden Ridges, Dec 1963, *Havel & School* NGF 17273 (BRI,K,L); Mt Kaindi, May 1974, *Katik & Larivita* LAE 62065 (BRI,K,L); ditto, Dec 1978, *Kerenga & Wabo* LAE 74380 (BRI,K,L); Edie Ck, Aug 1968, *Millar* NGF 12156 (BRI,K,L); Wagau, June 1964, *Millar* NGF 23475 (BRI,K,L); Edie Ck, Nov 1966, *Ridsdale* NGF 30279 (BRI,K,L); ditto, Sept 1964, *Sayers* NGF 19935 (BRI,K,L); Wau-Salamaua Track, 14 km NE of Wau, Aug 1982, *Streimann* 8506 (K,L); summit of Mt Kaide, Mar 1978, *Verdcourt & Johns* 5110 (K); Edie Ck, Sep 1953, *Womersley* 5375 (BRI,K); Edie Ck, 10 miles [16 km] from Wau, June 1960, *Womersley & Thorne* NGF 12810 (BRI); ditto, Sep 1961, *Womersley* NGF 13933 (BRI,K); above Wau on Edie Ck rd, July 1954, *Womersley & van Royen* 5939 (K); Edie Ck rd, Wau, Mar 1953, *Womersley & Taylor* 4788 (BRI, K); ditto, Oct 1965, *Frodin* NGF 26201 (BRI). CENTRAL PROVINCE: Woiitape, Aug 1968, *Ridsdale & Woods* NGF 33776 (BRI).

Distribution and habitat: *R. lanata* occurs in the Morobe and Central Provinces of Papua New Guinea between 1100–2300 m altitude. One specimen from the Sepik Province of New Guinea is also referable to this species. It occurs on the margins of montane rainforest or in secondary regrowth situations.

Phenology: Flowers and fruits have been collected throughout the year.

Affinities: *R. lanata* is closely related to *R. novoguineensis*. It is readily distinguished from this species by its villous leaves, short pedicels to 2 mm long and larger petals ($4\text{--}5.5 \times 3\text{--}4.5$ mm).

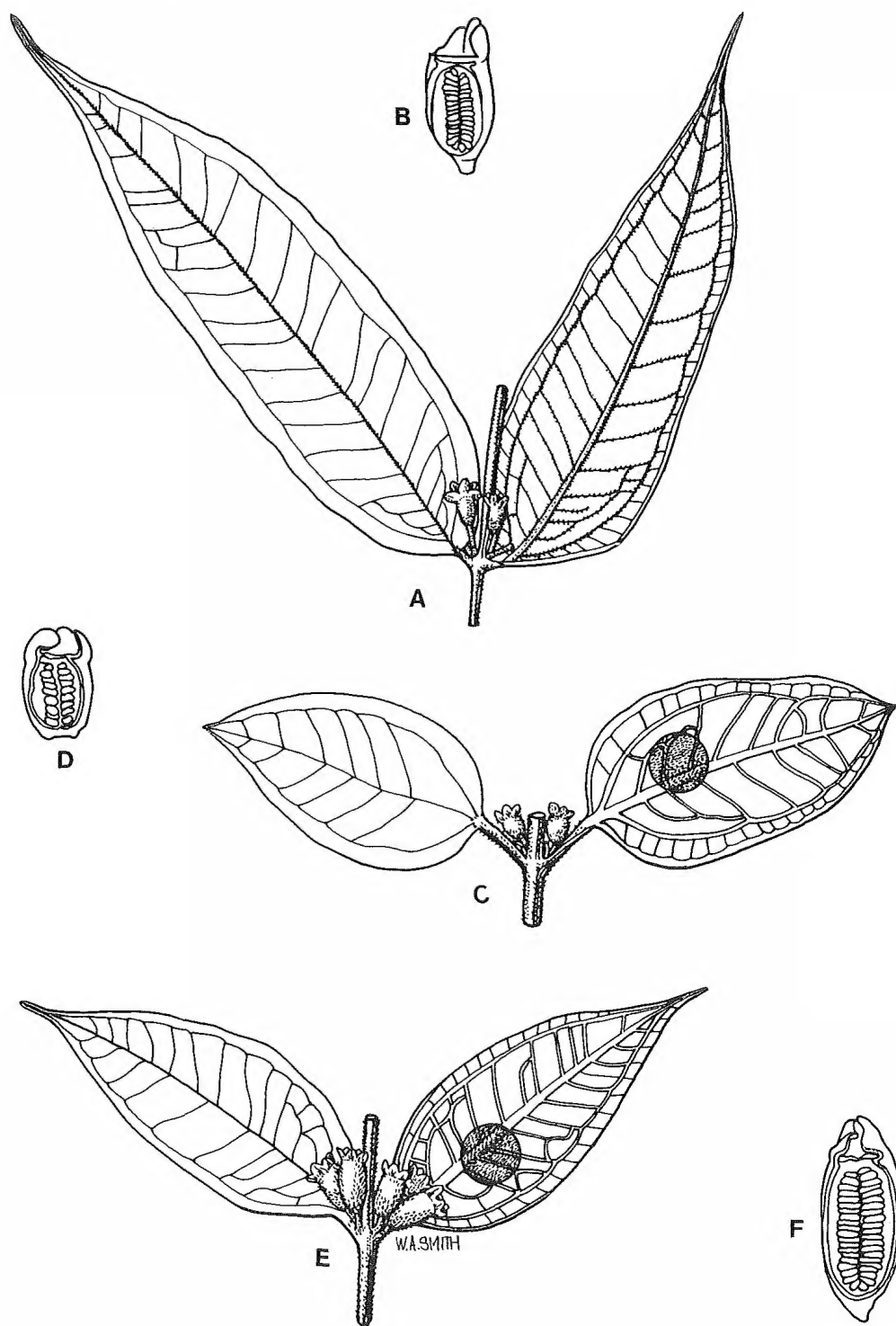


Fig. 2. *Rhodomyrtus novoguineensis*: A. flowering branchlet $\times 0.75$. B. L.S. of fruit $\times 2$. *Rhodomyrtus montana*: C. flowering branchlets $\times 1$. D. L.S. of fruit $\times 2$. *Rhodomyrtus lanata*: E. flowering branchlet $\times 0.75$. F. L.S. of fruit $\times 2$. A,B, Henty & Foreman 42614; C,D, van Royen & Sleumer 8205; E,F, Womersley & Thorne 12810.

Etymology: Named from the Latin *lanatus* (woolly) in reference to the indumentum of the leaves.

8. *Rhodomirtus montana* Guymner, sp. nov. affinis *R. novoguineensi* Diels sed ovulis paucioribus (48–54), bacca globosa et foliis brevioribus (3.7–7.5 cm longis) differt.
Typus: West Irian [Irian Jaya], Vogelkop Peninsula, Nettoti Ra., December 1961, van Royen & Sleumer 8087 (holo: BRI, iso: K, L distribuendi).

Shrubs to 4 m tall. Branchlets ferruginous-villous with simple hairs 0.4–1 mm long. Lamina elliptic or ovate-lanceolate, glabrous above except for hairs along the primary veins, ferruginous-villous below with hairs 0.4–1.2 mm long, 3-veined above the base, 3.5–7.5 cm long, 1.5–3.8 cm wide; apex acuminate, base cuneate; venation distinct, slightly sunken above, raised below, primary marginal veins 1–3 mm from base, 2–6 mm from margin; oil glands obscure. Petiole pubescent, 2–6 mm long. Inflorescence 1 per axil, monads, 10–15 mm long; pedicels pubescent, 1–4 mm long; prophylls ovate, acute, pubescent, 1.5–2.5 mm long. Flowers 5-merous; perigynium globular, villous, 3.2–4 mm long, 2.5–3 mm diameter at anthesis. Calyx lobes semi-circular to broadly ovate, villous, persistent, 2.5–3 mm long, 1.5–2.2 mm wide. Petals white inside, pink or brownish outside, 6–8 mm long, 4–5 mm wide. Stamens 76–88, in 4 whorls, filaments 3.5–4 mm long; anthers 0.4–0.5 mm long. Ovary 3-locular; ovules 16–18 per loculus, in 2 series of 8 or 9 on axile placentas; style villous at base, glabrous above, 4–5.2 mm long; stigma capitate, 0.4–0.5 mm diameter. Fruit globular, ferruginous-villous, crowned by persistent calyx lobes, 4–5 mm diameter. Seeds 48–54, reniform, flattened, finely reticulate, 1.5–1.6 mm long. Figs 2C & D.

Specimens examined: West Irian. Vogelkop Peninsula: N slope of Mt Nettoti, path to Wekari R., Dec 1961, van Royen & Sleumer 8087 (K, L); crest of Mt Nettoti, Dec 1961, van Royen & Sleumer 8205 (K, L); Mt Kobreimot above Testega, Anggi Lakes, Jan 1962, Sleumer & Vink BW 14152 (K, L).

Distribution and habitat: *Rhodomirtus montana* is known from the Vogelkop Peninsula, West Irian, New Guinea, at an altitude of 1900–2300 m. The species has been recorded from the edges of montane rainforest and montane thicket.

Phenology: Flowering specimens have been collected in December and January, and fruiting specimens in January.

Affinities: *Rhodomirtus montana* appears closely related to *R. lanata* based on its similar leaf tomentum and inflorescences. Nevertheless it is distinguished from this species by its smaller leaves, globular berries and fewer ovules per loculus.

Etymology: The specific epithet refers to the montane distribution of the species.

Acknowledgements

I wish to thank the Directors and staff of K, L, MEL and QRS for providing facilities for study and access to their collections. This work was supported partly by a grant from the Australian Biological Resources Study (ABRS). Mr Will Smith provided the line drawings.

Reference

SCOTT, A.J. (1978). A revision of *Rhodomirtus* (Myrtaceae). *Kew Bulletin* 33: 311–329.

Index of Collectors

Each collector's number is followed by the number of the species in parentheses. The list includes collections seen for *R. trineura*, *R. sericea*, *R. canescens* and *R. pervagata* not cited above.

Adams 20048 (1). Althofer 313 (3). Anderson 4010 (1).

Balgooy 1589 (4). Bailey AQ 045203 (4). Barry AQ 435873 (1). Barnes s.n. (3). Birch 32 (4). Blake 15812 & Webb (4). Blake 18806 (1), 20273 (4). Boyland 417 (5). Brass 577 (6), 1948 (4), 2098 (2), 2122 (5), 2297 (2), 5110 (6), 19333 (1), 20061 (2), 20134 (2), 23122 (6), 29576 (7), 33723 (3), 33754 (4). Byrnes 3925 (1).

Carr 13a (2). Clarkson 6572 (2). Clarkson & Stanley 672 (1). Clemens 5452A (7), AQ 045266 (1), AQ 045227 (1). Conn *et al.* 328 (7). Craven & Schodde 1108, 1311 (7).

Dallachy AQ 278670 (1). Darbyshire & Hoogland 8365 (6). Dockrill 86 (4), 900 (3). Doggrell s.n. (4). Domin 7310, 7311, 7312, 7313 (4).

Einar du Reitz s.n. (2), AQ 045206 (4). Everist 6063 (3), 9692 (1).

Fell 674, 1162 (1). Flecker 2033, 2287 (4), 9196 (3). Foreman *et al.* LAE 52473 (6). Foreman ex Katik LAE 59225 (6). Foreman *et al.* LAE 52473 (6). Foreman & Katik LAE 59225 (6). Forster 3869 & Liddle (3). Francis AQ 045182 (1). Frodin NGF 26201 (7).

Gibbs 6331 (4). Gray 328 (4), 1902, 2292, 2294, 2458 (3), 2459 (4). Guymer 2011 (1), 2013, 2017 (4), 2020 (2), 2027 (4), 2028 (3), 2056 (4), 2059 (5), 2065 (4). Haines 183 Q (4). Hamilton brothers AQ 45077 (3). Henty & Foreman NGF 42614 (6). Hockings 5(1). Hoover 6436 (6). Hyland 03086 (1), 5770 (4), 7058 (2), 7328 (5), 7348 (5), 7554, 7645 (1), 7762, 7767 (1), 7806 (1), 7975 (2), 8209, 8383, 8390 (1), 8488 (2), 8646 (4), 8687 (5), 9029, 9051 (1), 11423, 11424 (2), 11677 (4), 11681, 11682 (2), 11703 (4), 11710 (4).

Irvine 131 (4), 143 (3), 657 (2), 671 (1), 1005, 1116 (3).

Kajewski 1282 (2), 1379 (4), 1438 (5). Kanis 2149 (3). Katik & Larivita LAE 62065 (7). Kerenga & Wabo LAE 74380 (7).

Lelean & Stevens LAE 51245 (6).

Macfarlane 045223 (1). Martin & Hyland 1894 (2). Michael 681 (4). Millar NGF 12156, 23475 (7). Moriarty 276 (1), 1967 (4), 1974, 1975 (3), 1978 (4), 1984 (3), 2003 (4), 2005, 2007 (3), 2095, 2136, 2250 (4).

Pearson IA 10 (1). Pullen 7901 (6).

Ridsdale NGF 30279 (7). Ridsdale & Woods NGF 33776 (7).

Sanderson 124, 799 (4), 1208 (5), 1307 (4). Sankowsky G 575 & Sankowsky (3). Sayers NGF 19502, NGF 19935 (7). Sayers & Hartley 12609 (7). Scarth-Johnson s.n. (2). Schodde 3269 (4), 3292 (1), 4176 (3). Sharpe 1594, 1762, 4237 (1). Sleumer & Vink BW 14152 (8). Smith 3194 (1), 4043 (5), 4167 A, 4280 (4), 4664 (3), 10086 (2), 10437a (3), 11078, 11503 (5), 14633 (2). Stevens & Lelean 58273 (6). Stocker 660, 1737 (4). Stone & Streimann 10377 (6). Streimann 8375 (6), 8506 (7). Streiman 8375 (6), 8506 (7). Streimann & Katik NGF 28988 (6).

Tarden s.n. (4). Thomson 126 (1). Thorne 20733 & Dansie (3). Thorsborne 116, 219 (1). Tracey 14203, 14851, 15492 (1).

Unwin 32, 445, 762 (4).

van Altena 3620, 3650 (4). Van denberg & Galore NGF 42113 (6). van Royen & Sleumer 8087, 8205 (8). Verdcourt & Johns 5110 (7). Volck QF 57/108 (3), AQ 45209 (4).

Warrian 5006 (1). Webb & Taylor 4788 (7). Webb & Thorne NGF 12810 (7). Webb 5558, 5755 & Tracey (4). Webb & Tracey 5759 (3), 8625 (4), 9129, 9531, 9637, 10685 (1), 10794, 10804, 10939 (2), 12008 (1). Webb & van Royen 5939 (7). Whiffen & Risley 642 (4). White 1530 (4), 2986, 2986, 8016, 8991 (1), s.n., 10606 (2). Wilson 744 (4). Womersley 5375, NGF 13933 (7).

**NICOTIANA WUTTKEI (SOLANACEAE), A NEW SPECIES
FROM NORTH-EASTERN QUEENSLAND WITH
AN UNUSUAL CHROMOSOME NUMBER**

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Summary

Nicotiana wuttkei is described as new and compared with *N. suaveolens* Lehm. It is known only from a single population on the Atherton Tablelands in north-eastern Queensland. The haploid chromosome number $n = 14$ is the first record of this number for the genus *Nicotiana* worldwide.

Introduction

In 1967 Dr Herb Wuttke, a tobacco plant breeder with the Commonwealth Scientific and Industrial Research Organisation, Mareeba, discovered unusual plants of a *Nicotiana* species on the Atherton Tableland. Until then the only species thought to occur in north-eastern Queensland were *N. debneyi* Domin and *N. megalosiphon* Van Heurck & Muell. Arg. (Burbidge 1960). The Atherton Tableland plant was readily distinguished from the former by its staminal arrangement and from the latter by its very much shorter corolla tube. It was found to be resistant to both Queensland strains of blue mould (*Peronospora hyoscyami* De Bary), a serious disease of cultivated tobacco, and it was soon introduced into the blue mould resistance breeding programme. On and off for almost twenty years Dr Wuttke and then his successor in the breeding programme, Mr Vern Hansen, attempted to establish the true identity of the unplaced plant. The names *N. suaveolens* Lehm. and *N. exigua* H. Wheeler (now considered by Horton (1981) to be a synonym of *N. suaveolens*) were applied with some qualification by botanists at both BRI and CANB where material was sent for identification. Burbidge (in litt. 1967) suggested that the plant might belong to a new species but Horton, who saw at least one collection (*Wuttke* [AQ 38517] BRI) of glasshouse grown material at BRI and annotated the sheet "appears to be *N. suaveolens* but corolla tube unusually short", did not cite any material in her revision (Horton 1981). At the request of Mr Hansen, one of us (J.C.) critically examined glasshouse grown material, recollected the plant in the field and, on the basis of morphological, agronomic and pathological information combined with reference to the known patterns of distribution of *Nicotiana* in Australia, was persuaded that Wuttke's plant represented an undescribed species. This finding was reinforced when the second author obtained a haploid chromosome number of $n = 14$ for the plant. As a tobacco variety with blue mould resistance derived from this taxon is close to commercial release, it is felt that formal recognition of it at this stage is warranted.

Taxonomy

Nicotiana wuttkei J. Clarkson et Symon, **sp. nov.** similis *N. suaveolenti* Lehm. sed floribus minoribus et chromosomatum numero $n = 14$ differt. **Typus:** Queensland. COOK DISTRICT: 3 km from the Atherton to Ravenshoe road on the road to Tumoulin, 17°30'S, 145°28'E, 12 September 1984, J.R. Clarkson 5549 (holo: BRI; iso: AD,CANB,DNA,K,L,MBA,MO,QRS,PERTH).

Annual herb to 0.8(–1) m tall with one or a few stems from ground level. Indumentum on bracts, pedicels and calyx sparse to dense, a mixture of long, multicellular, globular-headed trichomes and short, unicellular, globular-tipped hydathodes; young growth sparsely to densely pubescent with long, eglandular, multicellular trichomes, glabrescent except for lower portions of stems and petioles of lower leaves. Leaves both radical and cauline, occasionally mostly radical, petiolate; lamina of lower leaves ovate or elliptic

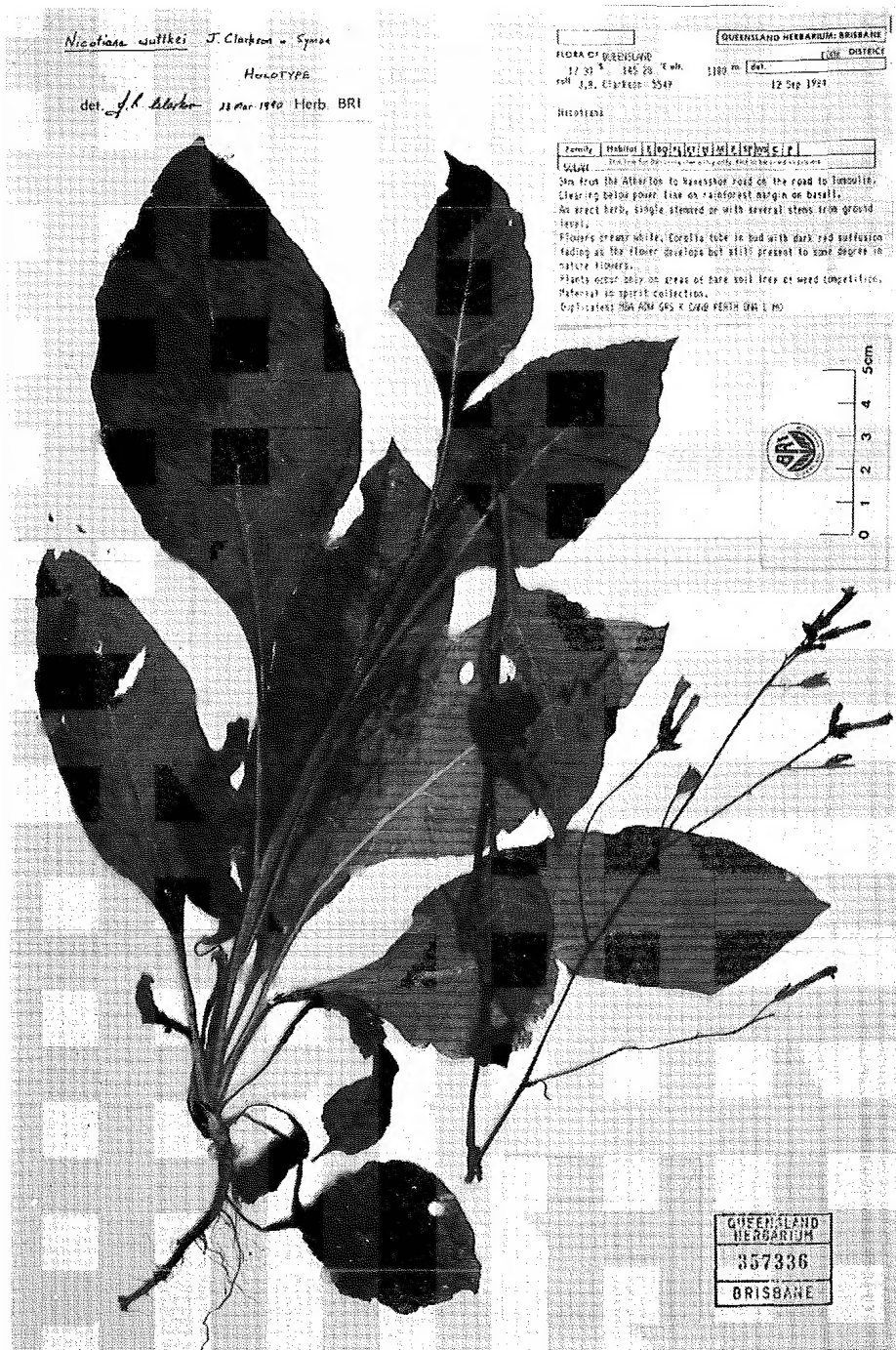


Fig. 1. Holotype of *N. wutkei* (Clarkson 5549).

becoming lanceolate or linear-lanceolate in the upper cauline positions, the basal ones 10–18 cm long, 4–7.5 cm wide occasionally reaching 28–34 cm × 14–16 cm in well grown individuals, those of the mid stem region 8–10 cm × 3.5–5 cm; apex acute to acuminate; base cuneate to attenuate; petiole 2–5(–7) cm long, narrowly winged by the decurrent leaf lamina. Inflorescence an elongate, sparsely branched panicle occupying 1/2 to 2/3 of the length of the stems; bracts linear to linear lanceolate, to 2–5 cm long; pedicels 12–15(–20) mm long in fruit. Calyx 7–10 mm long; lobes linear-lanceolate, equal to sub-equal, fused for about 1/2 their length. Corolla tube 16–18 mm long, c. 3 mm wide at the top of the calyx; tube proper slightly narrower than the throat cylinder; throat cup distinct, symmetrical, c. 3.5 mm diameter; corolla limb c. 9 mm diameter, closing in bright sunlight; lobes emarginate, fused for 1/3–1/2 their length. Upper 4 stamens level in throat cup, included; filaments free from corolla tube for distal 1–1.5 mm; fifth stamen c. 25 mm below the upper four, free portion of filament c. 10 mm long. Capsule ovate, 8–9 mm long, shorter than the calyx. Seeds reniform, 0.8–0.9 mm long; testa with serpentine wrinkles. **Figs 1 & 2.**

Specimens examined: Queensland. COOK DISTRICT: Tumoulin, to Atherton road, 11.2 km from Tumoulin, Apr 1978, Hansen [AQ 257106] (BRI); 3 km from Atherton to Ravenshoe road on the road to Tumoulin, Sep 1984, Clarkson 5549 (AD,BRI,CANB,DNA,K,L,MBA,MO,QRS,PERTH); Southedge Research Station near Mareeba (cultivated), Jan 1984, Clarkson 5122 (AD,BRI,MBA,QRS). MORETON DISTRICT: Tobacco Research Station, 2 ml [3.2 km] N of Beerwah (cultivated), Sep 1971, Wuttke [AQ 038517] (BRI).

Distribution and habitat: Known only from the type locality between Atherton and Ravenshoe on the Atherton Tableland, north Queensland. The plant occurs on the margins of closed forest on soils derived from basalt. It favours open ground free from competition from grass and weeds. The numbers of plants within the population at any one time appears to be very much dependant on the degree of disturbance and the amount of bare soil.

Conservation status: Because of its restricted distribution this species rated is 2K (under the name *Nicotiana* sp. 'Tomoulin') by Thomas and McDonald (1989).

Chromosome number: $n = 14$, determined from meiotic pollen mother cells in plants cultivated from seed from Clarkson 5549. In view of the new low number further counts are highly desirable.

Etymology: The species is named for Dr Herb Wuttke who spent many years as a plant breeder working with *Nicotiana* species and who found the first plants.

Notes: Chromosome numbers and their evolution in the genus *Nicotiana* were discussed at length by Goodspeed (1954). Section *Suaveolentes*, to which the 17 previously known Australian endemic species are referred, contains an almost complete aneuploid series of $n = 16$ to $n = 24$ from which, since Burbidge (1960) recorded the haploid number 23 for *N. umbratica* and *N. cavicola*, only $n = 17$ remains unknown. The discovery of a haploid number of 14 for *N. wuttkei* is interesting in that it falls outside this series and is the first record of 14 pairs of chromosomes for the genus worldwide.

The following modification will enable the species to be keyed out in the key to species of *Nicotiana* in Volume 29 of Flora of Australia (Purdie *et al.* 1982).

- 19 Corolla-tube usually more than 18 mm long, distinctly broadening up to the limb **N. suaveolens**
- 19: Corolla-tube usually 8–18 mm long, not distinctly broadening up to the limb **19a**
- 19a Radical leaves spatulate or oblanceolate, seeds C-shaped **N. goodspeedii**
- 19a: Radical leaves ovate or elliptic, seeds reniform **N. wuttkei**

Acknowledgements

We are indebted to our colleagues for their help and assistance in particular Barbara Randell, formally of AD, who provided the chromosome count and Hans Dillewaard of the Queensland Herbarium who prepared the scanning electron micrograph

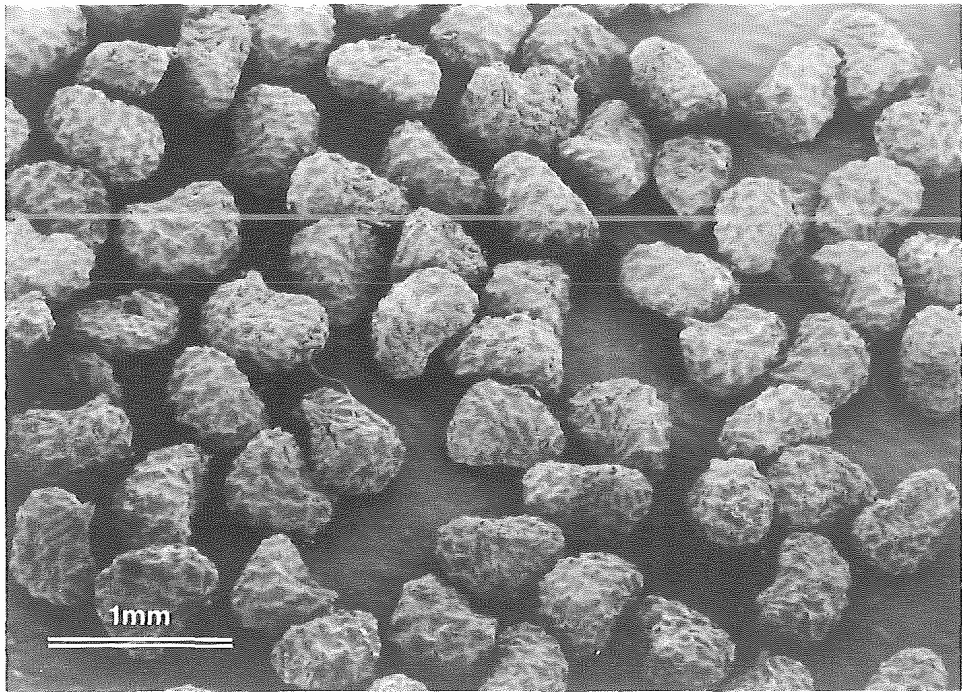


Fig. 2. Scanning electron micrograph of seeds of *N. wutkei*. (Seed from plants cultivated from Clarkson 5549).

of the seeds and photographed the holotype. Les Pedley and Rod Henderson critically read the manuscript and offered constructive comments. Finally we wish to acknowledge Vern Hansen of the Queensland Department of Primary Industry's Southedge Research Station for his useful comments on the behaviour of the new species and its close relatives in the blue mould resistance breeding programme.

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A REVISION OF *LAMPROLOBIUM* BENTH. (FABACEAE: BRONGNIARTIEAE)

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Summary

The genus *Lamprolobium* Benth. consists of two species, *L. fruticosum* Benth. and *L. grandiflorum* S.L. Everist ex R. Henderson sp. nov. described here, and is confined to tropical north-eastern Australia. A lectotype is chosen for *L. fruticosum*.

Introduction

As a result of a request for information from Roger Elliot on the variability of *Lamprolobium fruticosum* Benth. for a forthcoming volume of his Encyclopaedia (cf. Elliot & Jones 1990), I came across a specimen labelled as "type" of "*Lamprolobium grandiflorum* S.L. Everist" (AQ 22875) amongst the BRI material of *L. fruticosum*. Because of its overall appearance, it immediately struck me that the specimen represented a species other than *L. fruticosum*, but as it was incomplete and its flowers were heavily insect damaged, I was unable to place it with certainty.

Appended to this sheet is a note by L. Pedley to the effect that (as of March 1982) Everist's name had not been validly published.

I was convinced that it was of a distinct species of *Lamprolobium* when I subsequently came across relatively recent and complete flowering and fruiting material of the same taxon (Rodd & Hardie 4515 – AQ 443462) in the remainder of BRI specimens labelled *L. fruticosum*. This was confirmed by my colleague, Mr J.R. Clarkson (Mareeba), who visited the site of collection of the more-recent BRI material and re-examined the plants and made fresh collections of them and others he found in near-by areas.

To justify my former colleague's perception of the material he saw, I herewith formally validate his proposed name *L. grandiflorum* for this second *Lamprolobium* species.

Review of classificatory history

The genus *Lamprolobium* was erected by Bentham (1864) for a single, shiny-fruited, endemic Australian species he considered belonged in tribe Galegeae of Leguminosae (Fabaceae). In the structure of its seeds, however, it seemed to him unrelated to any other genera of this tribe except for the South American *Brongniartia* Kunth and *Harpalyce* DC. He segregated these three genera later as subtribe Brongniartiinae ('Brongniartieae') of tribe Galegeae (Bentham 1865) and this grouping was accepted by Hutchinson (1964) though at the tribal rather than subtribal rank. Even later authors, however, chose to disregard this classification since consideration of many attributes other than seeds suggested to them that *Lamprolobium* has much greater affinities with genera of the Bossiaceae (Benth.) Hutch. and it was therefore included in that tribe until recently by most workers (Polhill 1981). There, Polhill grouped it with *Plagiocarpus* Benth., *Templetonia* R. Br. and *Hovea* R. Br. in a so-called "Templetonia group" while other genera of the tribe, viz *Platylobium* Smith, *Goodia* Salisbury, *Aenictophyton* A. Lee, *Ptychosema* Benth., *Muelleranthus* Hutch. together with *Bossiaea* Vent., he held to comprise a second group, the so-called "Bossiacea group".

Crisp and Weston (1987) reviewed this grouping and, following cladistic analysis to establish relationships between genera and species of the Bossiaceae, the Brongniartieae and the allied Mirbelieae, concluded that to render the Bossiaceae and Brongniartieae monophyletic, the "Templetonia group" including *Lamprolobium* must be transferred to the Brongniartieae, leaving the "Bossiacea group" as the only members of the Bossiaceae. Their study and conclusions, based on consideration of 73 attributes of 64 taxa, are compelling and support both Bentham's and Hutchinson's earlier views on the relationships of *Lamprolobium*. Its placement in Hutchinson's Brongniartieae is thus accepted here.

The finding of a second species within *Lamprolobium* clearly upsets the generic description as traditionally given and necessitates modification of the key to the group given by Polhill (1981). It does not, however, require a realignment of the genus within the tribe as construed by Crisp and Weston (*loc. cit.*). The attributes of a circumscissile calyx and imparipinnate leaves with broad leaflets, apparently remain as the only unique diagnostic characteristics for this genus in this tribe.

Another species, *Galactia megalophylla* (F. Muell.) J.H. Willis, was originally described as *Lamprolobium megalophyllum* by F. Mueller (Mueller 1875) but it has since been shown conclusively (Willis 1967) that it correctly belongs in *Galactia* P. Br. as Mueller once thought. *Galactia megalophylla* was the manuscript name he used on his herbarium material of it.

Taxonomic Treatment

Lamprolobium Benth., Fl. austral. 2: 202 (1864). **Type:** *L. fruticosum* Benth.

Derivation of Name: from Greek *lampros*, shining, and *lobos*, pod, in relation to the shiny, smooth fruits.

Erect shrubs, often many-branched from near base, densely hairy on most parts. Leaves compound, often reduced to unifoliate state distally on branches, stipulate, lacking stipellae. Flowers shortly pedicellate, single on $\pm$ elongated, solitary, paired or clustered peduncles in axils of upper leaves or leaves at lower nodes of axillary branches. Peduncles bracteolate; bracteoles medial and distal on peduncles, deciduous. Calyx tube circumscissile at base; upper 2 lobes fused to produce a compound retuse or emarginate lobe. Petals yellow, clawed, glabrous. Stamens 10, glabrous, united in lower 3/4 to 7/8 into a cylinder completely open along the ventral (adaxial) side. Anthers alternately basifixed or dorsifixed. Ovary glabrous, flattened, many-ovulate. Stigma consisting of the papillose truncate style tip. Pod flattened, glabrous, many-seeded, shiny. Seeds oblique in pod, separated by bands of pith, conspicuously arillate.

Petals conspicuously exceeding sepals, 15–20 mm long; mature leaflets $\pm$ appressed silky hairy, tapered evenly to an acuminate tip . . . ***L. grandiflorum***
 Petals $\pm$ equalling or shorter than sepals, 5–8 mm long; mature leaflets $\pm$ moderately spreading hairy, contracted abruptly to a short mucro at tip . . . ***L. fruticosum***

Lamprolobium grandiflorum S.L. Everist ex R. Henderson, *sp. nov.* *L. fruticosum* Benthamii petalis sepala conspicue longioribus (usque ad duplo longioribus), foliis maturis subter et insuper sericeis et apici acuminato angustatis, et seminibus $\pm$ discoideis vel obloideis nec $\pm$ reniformis vel ovoideis differt. Frutices 1–2 m alti; folia 1-vel 3- (vel 5-) foliolata; foliola 4–12 cm longa petiolulum inclusa. Lobi sepalorum 6–9.5 mm longi. Petala flava, 15–20 mm longa unguis inclusa. Semina discoidea ad obloidea, 4.5–5.1 mm longa. **Typus:** Queensland. COOK DISTRICT: 3.6 km E of Lappa to Mount Garnet road, along mining access track turning off 18 km S of Lappa, 28 August 1990, J.R. Clarkson 8904 (holo: BRI; iso: DNA, K, L, MBA, MEL, MO, NSW, PERTH, QRS, distribuendi).

Shrub 1–2 m tall; stems single or with several arising from near base, pubescent with a close, dense, greyish or rusty tomentum. Leaves unifoliate, trifoliate or occasionally 5-foliate; stipules subulate, 3–5 mm long; petioles 8–32 mm long; rachis 0–32 mm long; mature leaflets narrowly elliptic to narrowly ovate, tapering $\pm$ evenly to base and apex, 4–12 cm long including petiolule 1.5–10 mm long, 1–2.5 cm wide, sericeous above and below, acute at base, acute acuminate at apex; acumen 1–3.5 mm long, sericeous. Peduncles 2–4 cm long; bracteoles subulate to narrowly triangular, 3–4 mm long, sericeous abaxially; pedicels to 5.5 mm long. Calyx sericeous abaxially, sparsely pubescent adaxially; tube 1.5–4 mm long; lateral and basal lobes narrowly ovate, 7–9 mm long, 1.8–3 mm wide, acute; compound lobe $\pm$ rectangular but shallowly notched distally, 6–9.5 mm long, 3.5–8.5 mm across at widest point. Standard $\pm$ ovate-orbicular, 15–20 mm long including claw 2.5–4 mm long, 13–15 mm across; wings $\pm$ oblong, 16–18 mm long including claw 1.5–2.5 mm long, 3.5–4 mm wide; keel 15–16 mm long including claws 2.5–3.5 mm long, 11–12 mm across (opened out). Staminal tube c. 10 mm long; anthers

elliptic in outline, 1.7–1.8 mm long. Ovary linear, 5–7-ovulate. Stigmatic surface atop and narrower than $\pm$ truncate style tip. Legume 35–55 mm long including stipe up to 5 mm long, c. 9 mm wide, tapered evenly or contracted abruptly to short persistent style base. Seeds $\pm$ discoid to obloid, 4.5–5.1 mm long, 3.8–4.6 mm wide; mature testa reddish brown to olive green, sometimes mottled with deep red or reddish brown. **Fig. 1.**

Specimens examined: Queensland. COOK DISTRICT: Gurrumba, Apr 1946, *Stevens* Cairns 10139 (BRI); 16 km SSE of Lappa on road following abandoned railway line, 17°28'S, 144°55'E, Apr 1985, *Rodd & Hardie* 4515 (BRI, NSW); 15.8 km S of Lappa on road to Mount Garnet, Aug 1990, *Clarkson* 8902 (BRI); 16.3 km S of Lappa on road to Mount Garnet, Aug 1990, *Clarkson* 8903 (BRI); 3.6 km E of Lappa to Mount Garnet road, along a mining access track turning off 18 km S of Lappa, 17°29'S, 144°58'E, Aug 1990, *Clarkson* 8904 (TYPE).

Distribution and habitat: So far, *L. grandiflorum* is known only from a small area to the north west of Mount Garnet in north Queensland (**Map 1B**), where it grows in eucalypt (*Eucalyptus melanophloia* F. Muell., *E. leichhardtii* Bailey) woodland with cypress pines (*Callitris columellaris* var. *campestris* Silba) on low undulating country in coarse sandy soil.

Phenology: Flowers and fruit have been collected in April and late August.

Conservation status: A coding of 2K, according to the criteria of Briggs and Leigh (1988), seems appropriate at this stage. Its distribution and need for conservation warrant closer study as it may have potential for plant breeding.

Etymology: The epithet is derived from Latin *grandis*, large, and *florus*, flowered, in allusion to the size of its flowers compared with those of *L. fruticosum*.

Notes: The original label for Cairns 10139 in QRS has been associated with specimen Cairns 10129 (QRS 31915) which is a specimen of *Mirbelia speciosa* subsp. *ringrosei* (Bailey) Pedley. Thus the presence of Stephens' original in QRS has not been confirmed. Conversely, the collector and place of collection of Cairns 10129 remain uncertain.

With the current interest in taxonomy of the economically important legumes and the critical study of several different groups within the family in Australia, it is surprising that a plant of such stature and appearance as *L. grandiflorum* should escape detection for so long. In his recently published book on herbaceous and shrubby legumes in Queensland, Hacker (1990) briefly touched on this species in his description of *L. fruticosum* where he recorded that the leaves can be "narrowly pointed". In this he undoubtedly was referring to the leaves of *L. grandiflorum*. His voucher specimens from near Chillagoe, however, are definitely of *L. fruticosum*.

Lamprolobium fruticosum Benth., Fl. austral. 2: 202 (1864). **Type:** Endeavour River, Queensland, July 1819, *A. Cunningham* 242/1819 (lecto (here designated): K).

Erect slender, openly branched shrubs, 0.3–2 (rarely –3) m high, the twigs tending to become pendant; branchlets and young leaves pubescent with a close, dense, usually rusty brown tomentum. Leaves imparipinnate or unifoliate; stipules narrowly triangular, 0.6–1.6 mm long, densely hirsute, caducous; petioles 6–30 mm long; rhachis 0–36 mm long; mature leaflets 1, 3, 5 or 7 per leaf, narrowly ovate to broadly elliptic and $\pm$ abruptly contracted at base and apex, 3–12 cm long including petiolule 1.5–4 mm long, 1–3 cm wide, pubescent above and below especially along nerves, obtuse at base, obtuse at mucronate tip; mucro 0.6–1.2 mm long, hirsute. Peduncles 8–12 mm long; bracteoles $\pm$ subulate, 1.5–2.3 mm long, densely hirsute abaxially; pedicels 1–1.5 mm long. Calyx densely hirsute abaxially, pubescent adaxially; tube 0.9–1.7 mm long; lateral and basal lobes narrowly ovate to narrowly triangular, 4.5–7 mm long, 1.5–2 mm wide, acute; compound lobe $\pm$ trapezoidal but deeply emarginate distally, 5.5–8 mm long, 5.5–5.8 mm across at widest point. Standard cordate, 5–7 mm long including claw 1–1.5 mm long, 5.5–6 mm across; wings $\pm$ obliquely oblong, 6–7.5 mm long including claw 1–1.5 mm long, 2–2.5 mm wide; keel $\pm$ semi-ovate in outline, 6–7 mm long including claws 1.25–1.5 mm long, 5.4–6.8 mm across (opened out). Staminal tube c. 4 mm long; anthers ovate in outline, 0.5–0.7 mm long. Ovary linear, 5–8-ovulate. Stigmatic surface atop the obliquely truncate, slightly expanded style tip. Legume 30–55 mm long including stipe 4–8.5 mm long, 9–10 mm wide, contracted abruptly and obliquely to the short persistent style base. Seeds $\pm$ reniform to ovoid, 5–7 mm long, 3.5–4 mm wide; mature testa olive

green to dark reddish brown or almost black, sometimes reddish brown mottled with black. Fig. 1.

Selected specimens (88 examined): **Queensland.** COOK DISTRICT: Pinnacle Creek, 4 miles [6.4 km] N of Walsh River, Jun 1929, *Tardent* [AQ 234637] (BRI); Browns Creek, Pascoe River, Jun 1948, *Brass* 19173 (BRI; ?A n.v.); Tozer Gap, Tozer Range, Jul 1948, *Brass* 19509 (BRI; ?A n.v.); mouth of Endeavour River, Cooktown, May 1970, *Blake* 23315 (BRI); E of Wrotham Park and W of Chillagoe, May 1970, *Webb & Tracey* 13513 (BRI); 33 miles [53 km] from Mt Carbine towards Cooktown, Jun 1972, *Wrigley & Telford* NQ1267 (NSW; ?CBG n.v.); 13 km S of Laura, on Peninsula Development road, Cape York, Oct 1974, *Hind* 622 (NSW); Heathlands Pastoral Station, Cape York, 11°45'S, 142°33'E, Mar 1980, *Morton* 579 (BRI,NSW; ?MEL n.v.); Lizard Island, Dec 1974, *Specht & Specht* LI 208 (BRI); ditto, May 1975, *Byrnes* 3195 (BRI); ditto, Aug 1987, *Grimshaw* ALS 64 (BRI); ditto, Sep 1988, *Batianoff* 10101 (BRI); ditto, Oct 1988, *Batianoff* 10257 (BRI); 42 km S of Palmer River, on Peninsula Development road, Apr 1980, *Clarkson* 3060 (BRI; ?K,MBA,MO,NT,PERTH n.v.); 9.7 km N of Fairlight, on Fairlight to Palmerville road, 15°41'S, 144°02'E, Apr 1980, *Clarkson* 3254 (BRI; ?K,MBA,NSW,QRS,PERTH n.v.); 53 km NNE of Laura, on road to Cooktown, Jun 1981, *Maconochie* 2716 (BRI; ?CBG,K,NT n.v.); c. 1 km N of "Gladstone" mine, Stannary Hills, May 1983, *Conn & De Campo* 1253 (BRI,NSW; ?AD,CANB,HO,MEL n.v.); 63 km from Chillagoe, on Wrotham Park road, Jul 1983, *Hacker* BH 404 (BRI); 0.5 km SW of dam on top of Mount Mulligan, c. 40 km NW of Dimbulah, Apr 1985, *Clarkson* 5881 (BRI; ?CANB,DNA,K,L,MBA,MEL,NSW,PERTH,QRS n.v.); 12 km from Herberton, on road to Irvinebank, Aug 1990, *Clarkson* 8905 (BRI,DNA,K,PERTH; ?MBA,MEL,QRS n.v.). **NORTH KENNEDY DISTRICT:** near Greenvale, Jul 1954, *Blake* 19454 (BRI; ?CANB,K,MEXU,MO,SP n.v.); Conjuboy road, Oct 1972, *Althofer* 325 (BRI); 4 km from "Valley of Lagoons" homestead, on road to Ingham, May 1977, *Williams* 77036 (BRI); ditto, Apr 1980, *Williams* 80062 (BRI); Poley Cow Creek, Broken River, 19°28'S, 144°46'E, Apr 1988, *Fell* DF 951 (BRI).

Distribution and habitat: *L. fruticosum* is confined to the north east of Queensland (Map 1A) but occurs in a wide range of community types from swampy and sandy heaths to grasslands, low closed forests, eucalypt woodlands (various species) and eucalypt forest (various species). It grows in a wide variety of soil types from dune sands, sandy loams, loams, gravelly clays and skeletal metamorphics on plains, undulating plains, ironstone and sandstone ridges, near-coastal dunes, rocky hillsides and stony mountain tops. Its recorded altitudinal range varies from sea-level to 750 m.

Phenology: Flowers and fruits have been collected from March to November, and probably occur throughout the year.

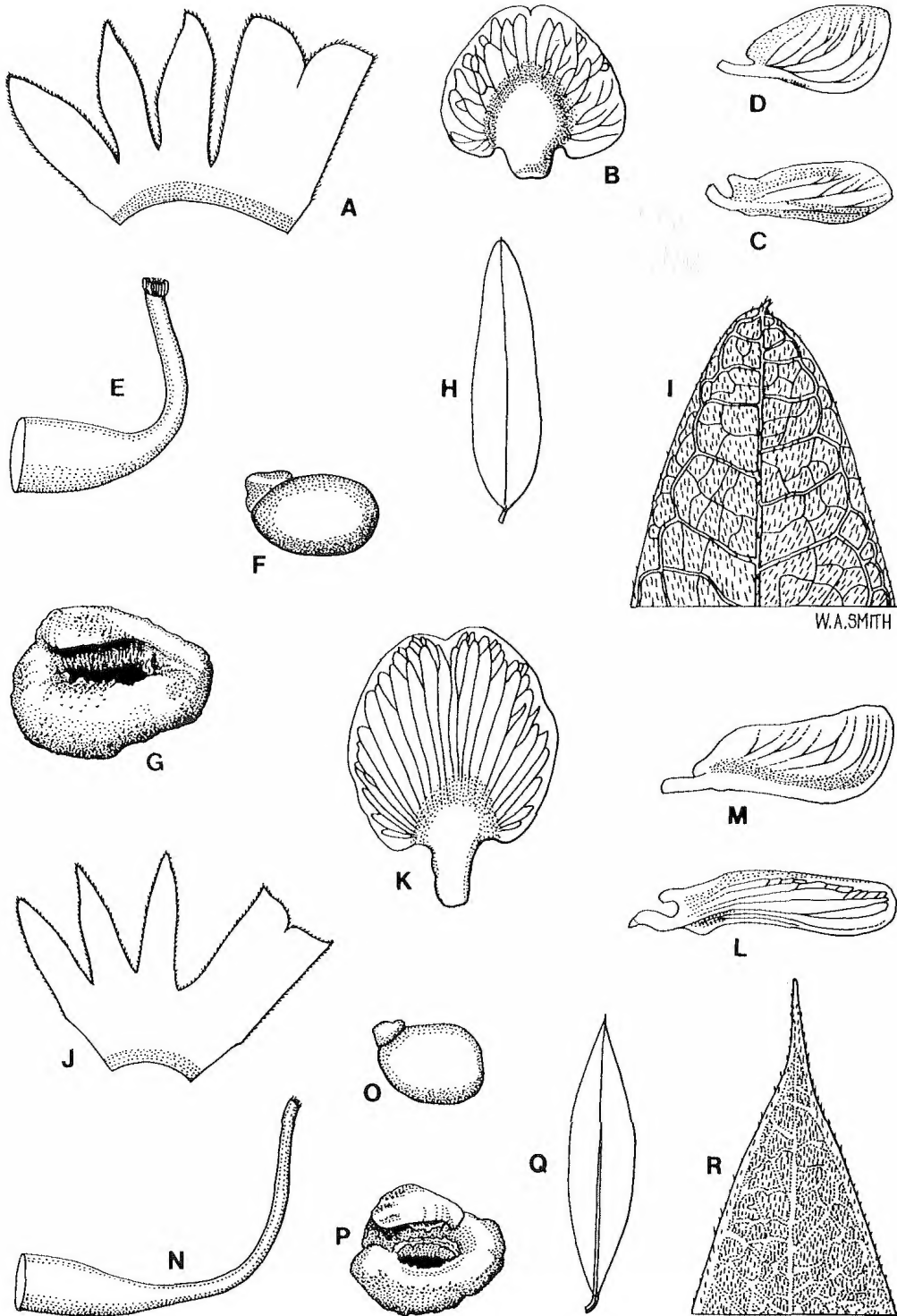
Conservation status: This species is widespread and is conserved in several National Parks, e.g. Lizard Island National Park. Its survival is not endangered.

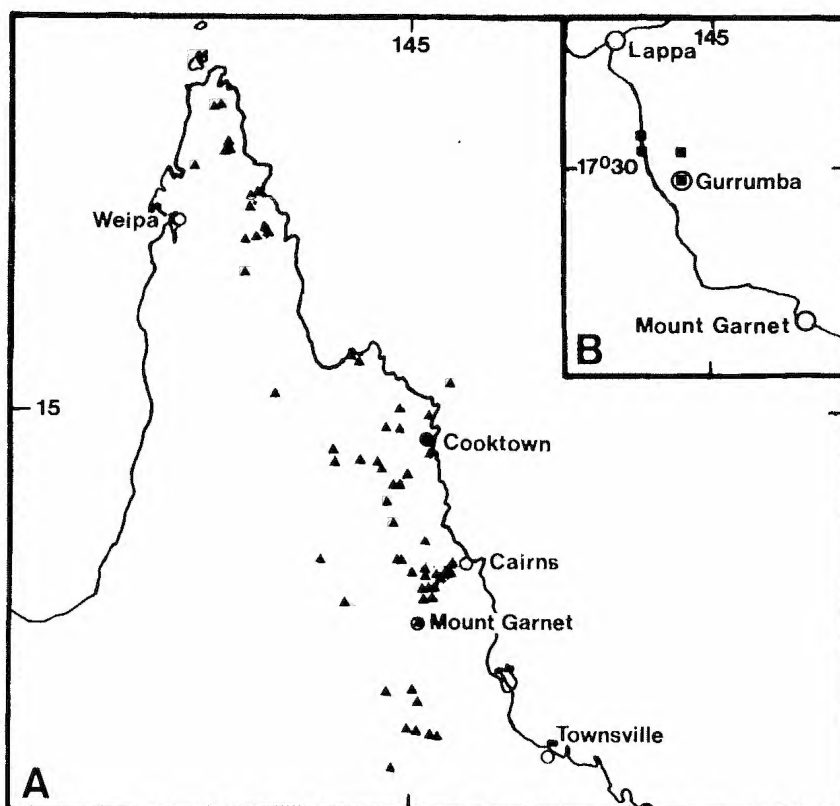
Notes: In describing *L. fruticosum*, Bentham (*loc. cit.*) cited both a Banks and Solander and a Cunningham specimen in his protologue. Only the Cunningham specimen (on two sheets) is at K though a packet containing seeds from Robert Brown's herbarium (presumably from a Banks and Solander specimen) is associated with it, i.e. mounted on one Cunningham sheet. It is clear from the sketches attached to that sheet that this specimen formed the major basis for Bentham's description in his protologue even though the specific epithet was taken up from Solander's manuscript name for the species (*Crotalariaiodes fruticosa*). Bentham undoubtedly derived the generic name from Cunningham's manuscript *Glycine lamprocarpa* written on the labels associated with his K specimen.

For these reasons the Cunningham sheet at K excluding material from Brown's herbarium is selected lectotype of Bentham's name. A good representative specimen of the species collected by Banks and Solander from Endeavour River is in the separate Banks and Solander collection at NSW (NSW 133343).

Notes attached to two specimens in BRI suggest the species is toxic to livestock but there appears no definite evidence to support these suspicions.

Fig. 1. *Lamprolobium fruticosum*: A. calyx (opened and flattened) showing shape of compound lobe × 4. B. standard (flattened) showing claw and basal lobes × 4. C. wing showing claw and basal lobe × 4. D. one side of keel showing claw and basal lobe × 4. E. style and stigmatic zone × 12. F. seed looking at back of aril × 3. G. aril from front × 12. H. leaflet (typical outline) × 0.5. I. apex of leaflet showing mucro, broad angle of major veins and sparser hairs × 3. *L. grandiflorum*: J. calyx (opened and flattened) showing shape of compound lobe × 2. K. standard (flattened) showing claw and basal lobes × 2. L. wing showing claw and basal lobe × 2. M. one side of keel showing claw and basal lobe × 2. N. style and stigmatic zone × 6. O. seed looking at back of aril × 3. P. aril from front × 12. Q. leaflet (typical outline) × 0.5. R. apex of leaflet showing acuminate tip, less broad angle of major veins and denser hairs × 3. A-E,H,I, Clarkson 8905, F,G, Scarth-Johnson 339A, J-N,Q,R, Clarkson 8904, O,P, Rodd & Hardie 4515 (all BRI).





Map 1. Distribution of *Lamprolobium* spp.: A. *L. fruticosum*. B. *L. grandiflorum*.

Acknowledgements

I am grateful to John Clarkson (MBA) who searched for *L. grandiflorum* in the Lappa area at my request and who subsequently found three separate populations of the plant. He also provided me with the type material. At BRI, Will Smith prepared the illustrations, Aileen Wood the maps and Andrew Franks SEM photographs of leaf-tips and seeds of both species. This assistance is gratefully acknowledged. An anonymous referee kindly brought the very relevant Crisp and Weston reference to my notice.

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NOTES ON *TRACHYMENE* RUDGE (APIACEAE) IN QUEENSLAND, 2

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Summary

A key to the species of *Trachymene* known to occur in Queensland is provided. A new species, *Trachymene montana* Holland, and a new variety, *T. bivestita* var. *pterocarpa* Holland, are described. Previous descriptions of *T. bivestita* (Domin) L. Johnson and *T. tenuifolia* (Domin) B.L. Burtt are amended. All species are listed with distribution, place of publication and notes on toxicity.

Introduction

In the first part of this work, (Holland 1989), a new species, *T. clivicola* Boyland & Holland, and new combination, *T. hookeri* (Domin) Holland were described and a new record for Australia, *T. cussonii* (Montr.) B.L. Burtt, was noted. This paper completes this treatment of *Trachymene* Rudge in Queensland with a key to the species, and descriptions of a new species and variety. This work was carried out as part of the Botany Branch Strategic Taxonomy Program.

Key to *Trachymene* in Queensland

1. Mericarps densely covered with hairs 1-1.5 mm long **1. *T. gilleniae***
 Mericarps glabrous, smooth or tuberculate 2
2. Fruits consisting of a single mericarp 3
 Fruits with two mericarps present, sometimes unequal in size 8
3. Mericarps more than 4 mm long (including wing if present) 4
 Mericarps less than 4 mm long 7
4. Mericarps with a thin 0.5-2 mm wide wing on outer edge 5
 Mericarps without a wing 6
5. Spreading multistemmed herb to 40 cm high; leaf blades deeply tripartite,
 up to 3 cm long; segments shallowly lobed; lobes 2-5 mm wide **2. *T. clivicola***
 Erect single-stemmed herb to 80 cm high; leaf blades deeply trisected,
 up to 7 cm long; segments deeply lobed; lobes 1-2 mm wide **6. *T. bivestita* var. *pterocarpa***
6. Stems and leaves glandular hairy **3. *T. glandulosa***
 Stems and leaves completely glabrous **4. *T. glaucifolia***
7. Mericarps 3-4 mm long with a prominent ring of large papillae on outer
 edge **5. *T. cyanantha***
 Mericarps 2.5-3.5 mm long, evenly papillose or completely
 smooth **6. *T. bivestita* var. *bivestita***
8. Leaves basal, hairy; leaf blades orbicular with 5-7 shallow lobes; lobes
 dentate **7. *T. geraniifolia***
 Leaves basal or cauline, glabrous or hairy; leaf blades deeply trisected
 and pinnatifid 9
9. Mericarps more than 4 mm long 10
 Mericarps less than 3.5 mm long 11
10. Plants tussock-forming, to 30 cm high **8. *T. cussonii***
 Plants erect, up to 1 m high **4. *T. glaucifolia***

11. Plants prostrate, creeping 12
 Plants erect, weakly erect or ascending 13
12. Leaf blades up to 2 cm long; mericarps 1.5–2 mm long 12. *T. psammophila*
 Leaf blades mostly more than 2 cm long; mericarps 2–3 mm long 11. *T. procumbens*
13. Leaves mostly crowded at base, a few small leaves on stem 14
 Leaves basal and cauline, not crowded at base 15
14. Mericarps less than 2 mm long; leaf segments obtuse 9. *T. ochracea*
 Mericarps 2–3.5 mm long; leaf segments acute 10. *T. incisa*
15. Slender, multistemmed, weakly erect or ascending herbs to 30 cm; leaf segments acute or acuminate, 0.5–1.5 mm wide 16. *T. tenuifolia*
 Erect, single-stemmed herbs usually more than 30 cm high, robust, often woody at base; leaf segments 1–6 mm wide, rounded or acute 16
16. Bracts narrowly triangular, often lobed, distinctly shorter than pedicels, 1–6 mm wide, fruit 1.6–2 mm long 15. *T. montana*
 Bracts subulate, entire, mostly equal or longer than pedicels, 1–2 mm wide; fruit 2–3 mm long 17
17. Leaf segments rounded or broadly acute, 2–6 mm wide; umbels 8–10 mm wide in fruit 13. *T. longipedunculata*
 Leaf segments acute or acuminate, 1–4 mm wide; umbels 10–16 mm wide in fruit 14. *T. hookeri*

1. *T. gilleniae* (Tate) B.L. Burtt, J. Bot. 79: 46 (1941); *Didiscus gilleniae* Tate, Report of the Horn Scientific Expedition Pt 3:188 (1896). Type: Northern Territory. Mt Gillen, 1894, *R. Tate* s.n., (holo: K, n.v.).

Distribution: Northern Territory and recently collected from the Selwyn Ranges in North-western Queensland.

2. *T. clivicola* Boyland & Holland, Austrobaileya 3(1): 135–139 (1989). Type: Queensland. GREGORY NORTH DISTRICT: Kurran HS, c. 160 km WNW of Jundah, June 1974, *D.E. Boyland* 7060 (holo, iso: BRI(AQ 378654)).

Distribution: Far western Queensland.

3. *T. glandulosa* (F. Muell.) Benth., Fl. austral. 3: 350 (1866); *Didiscus glandulosus* F. Muell., Proc. Roy. Soc. Tasmania 3: 238 (1857). Type: Queensland. BURKE DISTRICT: Nicholson River, Gulf of Carpentaria, August 1856, *F. Mueller* (holo: MEL(MEL 37000), photo BRI).

Distribution: North-western Queensland and the Gulf of Carpentaria.

4. *T. glaucifolia* (F. Muell.) Benth. loc. cit.; *Didiscus glaucifolius* F. Muell., Linnaea 25: 395 (1852). Type: South Australia. Elders Range, October 1851, *F. Mueller* (holo: K!, photo BRI).

Distribution: Western Queensland, New South Wales, Northern Territory, South Australia, Western Australia.

Note: Suspected of being toxic to stock.

5. *T. cyanantha* Boyland, Contr. Queensland Herb. 10 (1972). Type: Queensland. WARREGO DISTRICT: 24.2 km S of Cheepie, September 1967, *Pedley* 2449 (holo: BRI(AQ 024325)).

Distribution: Western Queensland.

Note: Known to be toxic to stock.

6. *Trachymene bivestita* (Domin) L. Johnson, Contr. N.S.W. Natl Herb. 3: 101 (1962); *Didiscus benthamii* var. *bivestitus* Domin, Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 10: 40 (1908). **Type:** Queensland. COOK DISTRICT: Newcastle Range, without date, *F. Mueller* (holo: MEL!(MEL 36985)).

Erect single-stemmed herb to 80 cm high. Stem thickened at base or slender with few or many flowering branches, glabrous or sparsely glandular hairy sometimes glaucous. Leaves cauline, a few crowded at base, leaf blades ovate or rounded in outline, usually much divided with non-glandular hairs on veins and margins and glandular hairs at base and on petioles. Lower leaves alternate; petioles dilated at base, 1.5–7 cm long; leaf blades deeply trisected, 1.5–7 cm long, lobes pinnatifid, often further divided, ultimate segments linear or narrowly oblong, acute, rounded or truncate, 1–3 mm wide. Upper leaves opposite, subtending inflorescence branches, sessile or shortly petiolate, entire or deeply trisected or further divided, 0.6–4.5 cm long, otherwise similar. Peduncles 2.5–14 cm long, densely glandular hairy at base. Umbels 1–2 cm wide with 12–75 flowers and 10–18 bracts; bracts narrowly triangular, subulate, 2–7.5 mm long and 3–6 mm wide, glandular hairy; pedicels 2–8 mm long. Petals obovate, 1–1.8 mm long and 0.6–1.3 mm wide, white or pale blue. Styles 0.8–2.5 mm long, bright blue. Anthers 1.2–2 mm long. Fruit with only one mericarp developing; mericarps obliquely rounded, laterally flattened, 2.6–5.5 mm long and 1.7–4 mm wide, glabrous, evenly tuberculate or entirely smooth, wingless or with a thin smooth wing 0.5–1 mm wide.

Two varieties are recognized:

- Mericarps wingless, 2.6–3.8 mm long and 1.7–3 mm wide, evenly tuberculate or smooth var. *bivestita*
 Mericarps winged, 5.3–5.5 mm long and 3.5–4 mm wide, slightly tuberculate; wing thin, smooth, 0.5–1.0 mm wide var. *pteroarpa*

***Trachymene bivestita* var. *bivestita* Fig. 1G.**

Selected specimens: (all BRI) Queensland. COOK DISTRICT: Lyasid [Lizard] Island, 1842, *Macgillivray* 52; 17.9 km SE of Alice R. crossing on the track from Kimba to the new Dixie-Oroners Rd, Jun 1981, *Clarkson* 3750; Boyle Creek (NW of Mareeba), Apr 1962, *McKee* 9153; Forsyth-Einasleigh road c. 48 km W of Einasleigh, Apr 1975, *Orchard* 4732; c. 14 km S of Mutchilba, towards Stannary Hills, May 1983, *Conn & De Campo* 1231; Blue Hills area, Mt Surprise Gemfields, 42 km from township of Mt Surprise, Apr 1985, *Champion* 139; Black Rock, 16 miles [25.6 km] S of Lynd Junction on Hann Hwy between Hughenden and Mt Garnet, May 1970, *Webb & Tracey* 10163.

Distribution and habitat: Occurs in north-eastern Queensland from Lizard Island and the Alice River in the north, to Black Rock near the Lynd Junction in the south. Found on sandy or rocky soils in open eucalypt woodland or grassy flats.

Trachymene bivestita* var. *pteroarpa* Holland var. nov. a var. *bivestita* mericarpo in ala expanso differt. **Typus:** COOK DISTRICT: Yaramulla Station, adjacent to Pinwill Cave, 80 km SW of Mt Garnet, April 1989, *V.J. Neldner* 2776 (holo: BRI(AQ 500288). **Fig. 1F.*

The distinguishing characters are set out in the key above.

Specimens examined. (all BRI): Queensland. COOK DISTRICT: Yaramulla Station, Gulf Development Road, Jul 1981, *Williams* 81116.

Distribution and habitat: Known only from the type locality in northern Queensland, in open *Eucalyptus erythrophloia* woodland adjacent to low closed forest in a collapsed area of lava tubes.

Etymology: The specific epithet is derived from the Greek, *ptero*, wing and *carpos*, fruit.

Note: The description of *T. bivestita* is based on Domin's diagnosis of *Didiscus benthamii* var. *bivestita* and on Queensland material most closely matching the type.

Two specimens from Laura sandstone area (*Clarkson* 4688 and *Byrnes* 3353) have fruits consisting of a single mericarp and have leaves similar to those of *T. bivestita* but they are more slender, more branched and have smaller umbels with fewer flowers and short glabrous bracts.

7. *T. geraniifolia* Bailey, Queensl. fl. 6: 2015 (1902) (Additions); *Didiscus geraniifolius* (Bailey) Domin, Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 10: 55 (1908). **Type:** Queensland. COOK DISTRICT: Mt Alexandra, November 1902, *Newport* 9 (holo BRI!(AQ 024332)).

Distribution: Rare on coastal mountains in north-eastern Queensland.

8. *T. cussonii* (Montr.) B.L. Burtt, J. Bot. 79: 45 (1941); *Hydrocotyle cussonii* Montr., Mem. Acad. Roy. Sci. Lyon, Sect. Sci. ser 2, 10: 211 (1860). **Type:** De l'île Art, (Pers de la Nouvelle Calédonie) (*n.v.*).

Distribution: Islands of the Capricornia Section of the Great Barrier Reef.

9. *T. ochracea* L. Johnson, Contr. New South Wales Natl Herb. 3: 100 (1962). **Type:** New South Wales: Waverley Downs (W. of Paroo River, near Hungerford), October 1912, *J.L. Boorman*, (holo: NSW (NSW 5406) *n.v.*).

Distribution: Western Queensland, New South Wales.

Note: Known to be toxic to stock.

10. *T. incisa* Rudge, Trans. Linn. Soc. London 10: 300 (1811). **Type:** Sydney Harbour, Port Jackson, May 1801, *R. Brown* (holo: MEL!(MEL 37071)).

Distribution: South-eastern Queensland, New South Wales.

11. *T. procumbens* (F. Muell.) Benth., Fl. austral. 3: 351 (1866); *Didiscus procumbens* F. Muell., Proc. Roy. Soc. Tasmania 3: 237. **Type:** Queensland. MORETON DISTRICT: Brisbane River, Moreton Bay, *F. Mueller* (MEL!).

Distribution: South-eastern Queensland, New South Wales.

12. *T. psammophila* Maconochie, J. Adelaide Bot. Gard. 2(2) (1980). **Type:** Northern Territory. Wessel Islands, September 1972, *P.K. Latz* (holo: DNA; iso: BRI!).

Distribution: Cape York Peninsula and the Wessel Islands in northern Queensland and the Northern Territory.

13. *T. longipedunculata* Maconochie, *loc. cit.* **Type:** Northern Territory. Wessel Islands, September 1972, *P.K. Latz* 3237 (holo: DNA; iso: BRI!).

Distribution: Cape York Peninsula and the Wessel Islands in far northern Queensland and the Northern Territory.

14. *T. hookeri* (Domin) Holland, Austrobaileya 3(1): 135–136 (1989). *Didiscus procumbens* var. *hookeri* Domin, *loc. cit.* **Type:** Queensland. COOK DISTRICT: Lizard Island, August 1848, *J. MacGillivray* s.n. (lecto K!(2 sheets), photo BRI!).

Distribution: North-eastern and far northern Queensland.

15. *Trachymene montana* Holland *sp. nov.* affinis *T. longipedunculata* Maconochie sed inflorescentiarum bracteis latioribus (2–6 mm latis), pedicellis quam bracteis longioribus et mericarpis parvioribus (1.6–2 mm longis) differt. **Typus:** Queensland. COOK DISTRICT: Tinaroo Creek Forestry Road, near Mt Haig, c. 4.5 km NNW of Danbulla, (17°06'S, 145°36'E), September 1980, *J.R. Clarkson* 3436 (holo: BRI(AQ 346129)).

Erect single-stemmed herb to 70 cm high with a short primary root. Stem thickened and somewhat woody at base, with many slender flowering branches, glabrous. Leaves cauline, not crowded at base; leaf blades broadly ovate in outline, somewhat membranous, glabrous or with non-glandular hairs on veins, sometimes sparsely glandular hairy at base and on petioles. Lower leaves alternate or opposite; petioles 0.5–3.6 cm long, dilated at base; leaf blades deeply trisected, (1.2–)1.5–8.3 cm long; lobes further deeply pinnatifid, sometimes further lobed; ultimate segments linear or lanceolate, obtuse or acute, 1–4 mm wide. Upper leaves opposite, subtending flowering branches; petioles to 1.2 cm long; leaf blades entire or deeply trisected and pinnatifid, 1.0–3.0 cm long; lobes linear or lanceolate, acute or obtuse. Peduncles slender, 1.0–7.7 cm long, glandular hairy at base. Umbels 7–10 mm wide (10–12 mm wide in fruit) with 20–42 flowers and 8–14 bracts;

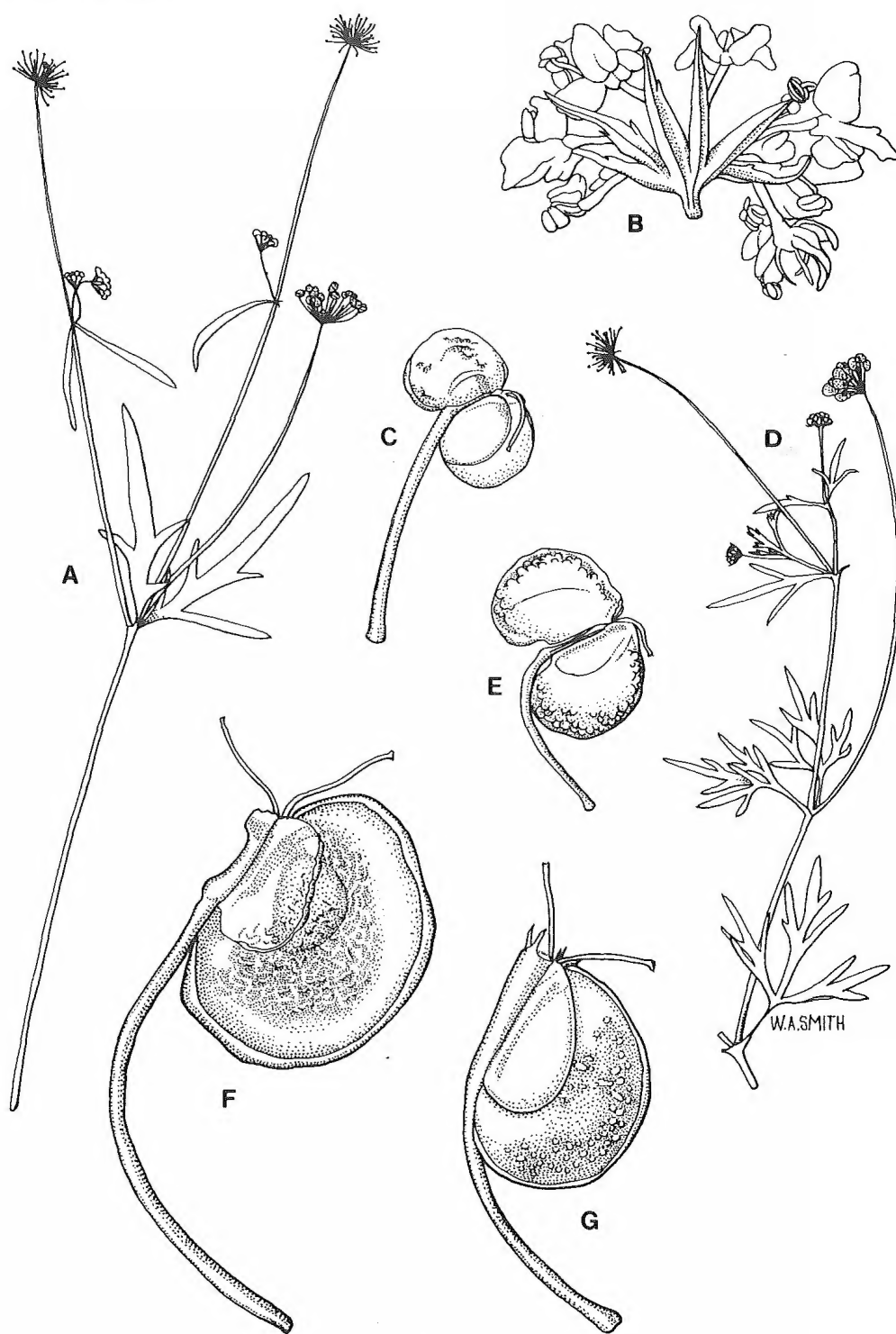


Fig. 1. *Trachymene montana*: A. flowering branchlet $\times 1$. B. umbel of flowers $\times 8$. C. mature fruit $\times 8$. *T. tenuifolia*: D. Flowering branchlet $\times 1$. E. mature fruit $\times 8$. F. *T. bivestita* var. *pterocarpa*: mature fruit $\times 8$. G. *T. bivestita* var. *bivestita*: mature fruit $\times 8$. (A-C, J.R. Clarkson 3436; D,E, L.S. Smith 12654; F,G, I.G. Champion 272.)

bracts narrowly triangular, entire or lobed, acute or acuminate, 1–3.4(–4.2) mm long and 0.2–0.6 mm wide at base, glabrous; pedicels slightly longer, or up to three times as long as bracts, 1.8–3.8(–4.6) mm long. Petals broadly elliptic, rounded, 0.8–1.4 mm long and 0.5–1 mm wide, white or pink. Styles 0.3–1.2 mm long, white or pink. Anthers 8–16 mm long. Fruit of paired mericarps, semicircular in outline, laterally flattened, 1.6–2.0 mm long and 1.2–1.8 mm wide, wingless, glabrous, tuberculate. **Fig. 1A–C.**

Specimens examined (all BRI): **Queensland**, COOK DISTRICT: S.F.R. 185, Douglas Ck area, Apr 1964, *Dansie* 3048; S.F.R. 185, Apr 1964, *Hyland* 3048; 9.6 km SSW of Irvingbank, Apr 1962, *Whitehouse* s.n. **NORTH KENNEDY DISTRICT:** East of Baal Gammon Mine, c. 1 km N of Herberton to Irvingbank Rd., c. 7 km W. of Herberton, Jun 1983, *Conn & De Campo* 1278; 19.2 km SW of Herberton, junction of Woolawan and Little Woolawan Cks, May 1962, *Whitehouse* s.n.; Mt Dryander, western slope, Apr 1978, *Byrnes* 3878 & *Clarkson*.

Distribution and habitat: North-eastern Queensland on mountains and plateau areas from the Douglas Ck area north of Atherton to Mt Dryander near Proserpine. It occurs in dry rainforests or open *Eucalyptus* forests.

Affinities: This species is related to *T. longipedunculata* Maconochie and *T. hookeri* (Domin) Holland. *T. longipedunculata* has 1–2 mm wide bracts longer than the pedicels and fruits more than 2 mm long. *T. hookeri* is taller, usually 1–2 mm high, with more divided leaves and fruits 2–3 mm long.

Etymology: The specific epithet was chosen to indicate the montane habitat of this species.

Note: A specimen from Mt. Spurgeon (*White* 10658) has slightly larger umbels and fruits but resembles *T. montana* in all other ways.

- 16. *Trachymene tenuifolia* (Domin) B.L. Burt, J. Bot. 79: 45 (1941); *Didiscus tenuifolius* Domin, Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 10: 58 (1908). Type:** "Australia, sine statione indicata, e Neapoli misit" *Sprenger* (sub no. 26)" (holo: K!, photo BRI).

Weakly ascending multistemmed herb to 30 cm high with a slender primary root. Stems slender, weak, glabrous, with few or many slender flowering branches. Leaves mostly basal; leaves blades ovate in outline, much divided into many narrow segments, glabrous or with a few hairs on veins. Lower leaves mostly crowded at base; petioles 0.5–5 cm long, glabrous or with a few hairs; leaf blades trisected almost to base with lobes deeply trisected and further deeply divided; 1–3 cm long; ultimate segments linear, acute or acuminate, 0.5–1.5 mm wide. Upper leaves entire or deeply bi- or trisected, sessile or shortly petiolate, 0.5–2.2 mm long, otherwise similar to lower leaves. Peduncles slender, ascending, 1.5–8.5 cm long and 0.3–0.5 mm thick, glabrous or with a few glandular hairs at base. Umbels 5–10 mm wide with 7–25(–33) flowers and 8–12 bracts; bracts filiform, acuminate, 1.7–3.8(4.5) mm long and 1–3 mm wide at base, glabrous; pedicels 1.5–4 mm long. Petals obovate, 0.8–1.2 mm long and 0.5–0.8 mm wide, pale pink or white. Styles 0.5–1.0 mm long, white. Anthers 6–10 mm long. Fruit of paired mericarps; mericarps semicircular in outline, slightly laterally flattened, wingless, 1.2–2 mm long and 0.8–1.3 mm wide, glabrous, smooth or tuberculate. **Fig. 1 D–E.**

Selected Specimens (all BRI): **Queensland**, COOK DISTRICT: Friday Is., without date, *Hasaiell* s.n. [AQ 089246]; Thursday Is., May 1906, *Tate* 27; Mutee Head, Jun 1988, *Forster* 4468; Wenlock, Batavia R., Jul 1948, *Brass* 19707; Tucanoo, c. 16 km S of Cape York (Laradenya Mouth), Oct 1965, *Smith* 12654.

Distribution and habitat: Most commonly found on sandy foredunes from Friday Is. to Batavia on the Wenlock River.

Affinities: *T. psammophila* Maconochie is similar to this species but is more prostrate with thickened stems and trilobed leaves with ultimate segments 2–4 mm wide.

Three specimens (*Scarth-Johnson* 1311A, *Clarkson* 2101, *Morton* 1282) resemble *T. psammophila* but have more divided leaves.

Note: This species was originally described by Domin from a specimen of uncertain origin and without fruiting material. Domin distinguished the species on the basis of the very narrow leaf segments. This description is based on specimens which most closely match the type cited by Domin.

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Reference

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A REVISION OF THE YELLOW BLOODWOODS (MYRTACEAE: *EUCALYPTUS* SER. *NAVICULARES* MAIDEN)

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Summary

Yellow bloodwoods, a well-known group now accepted as comprising 12 taxa of largely Queensland eucalypts, is revised. Five new species, *Eucalyptus scabrida*, *E. bunites*, *E. petalophylla*, *E. aureola* and *E. leptoloma* and two new subspecies *E. peltata* subsp. *dimorpha* and *E. watsoniana* subsp. *capillata* are described. The buds and fruits of each new taxon are illustrated where relevant and a key and distribution maps of all taxa are provided. The paper includes a summary of the five previously published species, notes on the classification of the series and comparisons in tabular form of all accepted bloodwood groups (informal *Eucalyptus* subgen. *Corymbia* Pryor & Johnson).

1. Bloodwoods

The bloodwoods are a natural and distinctive group of species in *Eucalyptus* occurring in all mainland States. They were given prominence by Bentham (1867) when he erected the *Eucalyptus* subseries *Corymbosae* based on a combination of characters concerning the inflorescence, fruit and seeds. The *Corymbosae* comprised 16 species in Bentham's treatment but subsequent research has resulted in the publication of at least 80 (Carr & Carr 1987). Furthermore, several natural groups within *Corymbosae* have been recognised (Blakely 1934 and subsequent authors).

Most of the species in the subseries or those published later and of obvious affinity are rough-barked, have winged seed¹, and belong to what are commonly called "red bloodwoods". A much smaller group (all rough-barked species) is the "yellow bloodwoods" which have unwinged seed², while there are three completely smooth-barked species, also with unwinged seed, viz *E. maculata* Hook., *E. henryi* Blake and *E. citriodora* Hook. Three other species have been variously placed in the red or the yellow bloodwoods or, in the case of two of them, *E. jacobsoniana* Blakely and *E. trachyphloia* F. Muell., in monotypic series (see later).

The species so far referred to are known collectively as the "woody-fruited bloodwoods". We dissociate them totally from the group known as the "paper-fruited bloodwoods". Blakely (1934) confused these two groups, but the taxonomic distinctions were discussed and clarified by Blake (1953) who erected two series to accommodate the groups, viz *Corymbosae*, based on Bentham's subseries and *Clavigerae*, based on an informal unranked taxon of Maiden (1923). Pryor and Johnson (1971) followed Blake in distinguishing them and equating their rank. They differed from Blake in their erection of informal subgenera (*Corymbia* and *Blakella* respectively) for the two groups in contrast to Blake's series which were largely accepted by Chippendale (1988). In this paper, we do not attend to the question of rank at these levels which is under consideration by others for the whole genus *Eucalyptus*, but treat the yellow bloodwoods as a series following Maiden (1920) and Chippendale (1988).

¹ The hyaline wing approximates the length of the body of the seed. We use the term "wing" purely descriptively with no functional implication.

² The seed of *E. leptoloma* may have a terminal appendage much shorter than the length of the body of the seed (see later).

2. Recognition of yellow bloodwoods as a distinctive group

a. General

Yellow bloodwoods are a relatively small group of species endemic to eastern Australia. They are trees usually recognisable in the field by their striking yellowish, flaky, rough bark, although they can be confused in this character with the related *E. trachyphloia* (an anomalous bloodwood, see later) and possibly with the quite unrelated *E. similis* Maiden, *E. phoenicea* F. Muell. and *E. cloeziana* F. Muell., all of which occur within or near to the geographic range of the yellow bloodwoods in Queensland.

b. Taxonomic history

The first species of the series to be formally described was *E. eximia* Schauer in 1843. This is understandable as this species is prominent in the hinterland of Sydney. All other species in the series are endemic to Queensland and were not discovered by botanists until many years later.

It is unlikely that Schauer was apprised of the field appearance of *E. eximia* and his description covers only leaves, inflorescence structure, and flowers. The inflorescence was given as a "terminal panicle".

The inflorescence, which is only pseudo-terminal (Johnson 1972), was the main character on which Benth. (1867) based his subseries *Corymbosae* in "Flora Australiensis". A similar inflorescence occurs in *Porantherae* Benth., but the author correctly distinguished the anther type in his series *Porantherae* from that of the series *Normales* Benth. where the *Corymbosae* were placed.

The second yellow bloodwood recognized, *E. peltata*, was published by Benth. (1867) in "Flora Australiensis", and was placed in *Corymbosae*. Mueller had communicated some information to Benth. about bark of *E. peltata* ("dark shining brittle and flaky but persistent") but there is still no bark information on *E. eximia* in "Flora Australiensis".

Benth. described seed characters when possible and reported the winged seed for most of the red bloodwoods, although the divergent seed form of *E. calophylla* R. Br. ex Lindley was pointed out. He correctly, though briefly, reported the seed form of *E. peltata* based on information from Mueller but seeds were not mentioned under *E. eximia*. Hence the natural affinity between the two species was not evident to him and they are widely separated in Benth.'s treatment.

Bark characters in eucalypts were given prominence some years earlier by Mueller (1858) in a somewhat facile classification in which he grouped some boxes and ironbarks with several bloodwoods, including *E. trachyphloia*, in an informal, unranked taxon, *Rhytiphloiae* (wrinkled bark). This may have been the reason for Benth.'s placement of this species in series *Porantherae* in "Flora Australiensis". Mueller's description of the bark in the protologue of *E. trachyphloia* as "frustuloso" (fragmented) is important as it draws attention to the tessellated nature of the bark of the species, which is also seen in most box (*Porantherae*) species. Apart from the anomaly of *E. trachyphloia*, Benth. was aware of a fundamental disparity between the boxes and the bloodwoods, i.e. the fundamentally different anthers, which resulted in his grouping them into different taxonomic series.

Mueller published a third yellow bloodwood, *E. watsoniana*, in 1876. The bark was described as "persistent, wrinkled and sometimes scaly, red-brownish", the inflorescences as "panicles terminal" and the seed as "winged"! (terminology from Maiden's translation 1920). Mueller referred to it as a "bloodwood" but there are no further clues to its affinity. Maiden (1920) correctly allied it (inasmuch as they are bloodwoods in the broad sense) with *E. maculata*, *E. eximia*, *E. corymbosa* Smith (syn. *E. gummifera* (Gaertner) Hochr.) and *E. abergiana* F. Muell., yet not with *E. peltata* which he treated in the previous few pages.

E. leichhardtii was published by F.M. Bailey in 1906 and the bark was given as "thick, spongy and somewhat lamellar ... light yellowish brown" - probably the most useful description of yellow bloodwood bark to that time. The inflorescence was given

as a "terminal panicle" and the seeds were adequately described. It is unfortunate that this species with the most informative description to date has been consistently downgraded, firstly as conspecific with *E. peltata* by Maiden (1920) then by Blakely (1934), and later as a subspecies of *E. peltata* by Johnson and Blaxell (1973). The subspecies status was followed by Chippendale (1988).

The most recently published yellow bloodwood is *E. bloxsomei* Maiden in 1925. Maiden called it a "bloodwood" and more specifically a "yellow jacket" or "yellow bloodwood". He gave no description of the seeds yet he clearly grew seedlings for his diagnosis. He related the species to *E. peltata* and *E. watsoniana* and paid particular attention in the protologue to the essential characters of the seedlings.

In addition to these species, we name seven new taxa in this study. While some of them were collected early this century, none was recognized as distinct until recent years. All of the new taxa are quite restricted in their distribution, and this factor has certainly delayed their discovery and/or recognition.

3. Various classifications

Blakely (1934) was the first botanist to segregate red bloodwoods (as subseries *Neocorymbosae* Blakely) from yellow bloodwoods, which name he gave in parentheses following the heading "xi Subseries *Ochrophloiae*". This latter subseries comprised *E. peltata*, *E. toreliana*, *E. eximia*, *E. bloxsomei*, *E. watsoniana*, and *E. jacobsiana*. The inclusion of *E. toreliana* was unqualified, while *E. jacobsiana*, with its stringy bark, was stated as having "no very close affinities in its Subseries". Blakely mentioned a similarity of *E. jacobsiana* with *E. trachyphloia*, which he placed unequivocally with the red bloodwoods while merely describing the bark as "rough, persistent throughout". The seeds of *E. trachyphloia* were described as "winged". Hence, inaccuracies and ambiguity resulted in a less than satisfactory classification, although we agree that all the species discussed so far are bloodwoods in the traditional senses. A significant contribution by Blakely was the segregation of *E. maculata* and *E. citriodora* in a third subseries (*Maculatae*). Their allied species, *E. henryi* was not published until 1977.

Blake (1953), in his treatment of "northern" Australian species, placed *E. trachyphloia* ("seed unwinged") and *E. jacobsiana* ("seed not winged") with the red bloodwoods and apparently associated them with *E. nesophila* Blakely which he incorrectly stated had seeds "not winged". In the conclusion to the section on *E. series Corymbosae*, he drew attention to the distinction ("unwinged seeds and some peltate leaves") within the series of yellow bloodwoods as well as the associated *E. subseries Maculatae* Blakely (*E. citriodora* and *E. maculata*) none of which was treated in this survey. It is curious with his attention to seed characters that Blake did not exclude *E. trachyphloia* and *E. jacobsiana* from the red bloodwoods.

Pryor and Johnson (1971) appear to follow Blakely rather than Blake in their informal treatment, although they improved Blakely's classification by the exclusion of *E. toreliana* and *E. jacobsiana* from "true" yellow bloodwoods.

In a recent informal classification of all the bloodwoods, Carr and Carr (1987) arranged the species in a manner little different from Pryor and Johnson's. The main modifications were their placement of *E. toreliana* in *E. series Maculatae* and they allied *E. jacobsiana* with *E. trachyphloia* in a separate series. Unlike Pryor and Johnson they diagnosed their supra-specific taxa.

Chippendale (1988), in his comprehensive treatment of the genus, formally erected monotypic series each for *E. jacobsiana*, *E. trachyphloia* and *E. toreliana*. He raised the *E. subseries Maculatae* to series rank, and accepted the established series *Termin-aliptera* and *Naviculares* for the red and yellow bloodwoods respectively.

We accept Chippendale's assigning of species to the various series but we, in addition, define the essential morphology of the yellow bloodwoods and publish five new species and two new subspecies in the group. At this stage in our review we believe it is useful to summarise these diagnostic criteria of all the bloodwood groups in tabular (Table 1) and key form.

Table 1. Diagnostic characters of the bloodwood series

Series (after Chippendale, 1988)	bark	inflorescence (see series description)	outer operculum shed	seed (mature)	stigma**
<i>Terminaliptera</i> Maiden (red bloodwoods)	rough (tessellated) or smooth	"compound" pseudo-terminal	at flowering	terminally winged ("Terminalipterae") not winged ("Gummiferae")*	mop
<i>Trachyphloiae</i> Chippendale	rough (flaky)	"compound", pseudo-terminal	at flowering	not winged	mop
<i>Jacobsianae</i> Chippendale	rough (fibrous)	"compound", pseudo-terminal	at flowering	not winged	mop
<i>Naviculares</i> Maiden (yellow bloodwoods)	rough (flaky)	"compound", pseudo-terminal	during bud development	not winged	tapered
<i>Torellianae</i> Chippendale	Smooth (weakly tessellated at base)	"compound", pseudo-terminal	during bud development	not winged	mop-tapered
<i>Maculatae</i> (Blakely) Chippendale	smooth	"compound" axillary	near or at flowering	not winged	mop

* Comprising *E. calophylla* R. Br. ex Lindley, *E. gummifera* (Gaertner) Hochr. and *E. haematoxylon* Maiden.

** Terminology as in Boland & Sedgley (1986).

4. Key to the bloodwoods

1. Seed not winged or with appendage much shorter than body of seed, keeled on broad dorsal side, shiny red-brown 2
Seed with terminal wing approximately the length of body of seed, or if lacking terminal wing, ridged longitudinally and sometimes with rudimentary lateral wings; outer operculum persistent till flowering series **Terminaliptera**
2. Outer operculum persistent till flowering 3
Outer operculum shed before flowering 5
3. Bark smooth; inflorescences 3-flowered, arranged on axillary axes among upper leaves. series **Maculatae**
Bark rough; inflorescences 7-flowered, arranged in leafless terminal clusters 4
4. Bark fibrous series **Jacobsianae**
Bark flaky, tessellated series **Trachyphloiae**
5. Bark mostly smooth and green, with rough basal stocking; inflorescences 3-flowered series **Torellianae**
Bark flaky, yellowish, tessellated over whole trunk; inflorescences 7-or more-flowered series **Naviculares**

5. Yellow bloodwoods

Eucalyptus series *Naviculares* Maiden, Crit. Revis. *Eucalyptus* 7: 109 (1925); *E.* subser. *Corymbosae* Benth., Fl. austral. 3: 198 (1867) ex parte excl. type; *E.* subser. *Ochrophloiae* Blakely, Key *Eucalypts* 91 (1934). Type: *E. eximia* Schauer (lecto: *vide* Chippendale, Flora of Australia 19: 502 (1988)).

Trees mostly 5–15 m tall, occasionally to 22 m, forming a lignotuber. Bark loose and flaky, irregularly tessellated, persistent at least to small branches, golden-yellow, orange- or brownish yellow, weathering on the outside to pale brown. Cotyledons reniform. Seedling leaves petiolate, decussate and remaining opposite, discolorous, hairy (Fig. 1), peltate in some species. Juvenile leaves alternate, peltate in most species, sometimes persisting in the mature crown. Adult leaves formed in most species, petiolate, alternate, lanceolate or falcate, bright green or grey-green, shiny or dull, concolorous, rarely discolorous, glabrous; side veins pinnate at relatively wide angle, terminating in distinct intramarginal vein; reticulation dense, oil glands numerous, small, one per areole. Unit inflorescences arranged decussately on leafless ends of branchlets whose terminal leaf bud aborts (pseudo-terminal, apparently compound inflorescence), usually 7-flowered, sometimes to 13-flowered, rarely to 21-flowered. Buds ovoid to clavate, smooth when fresh, but often ribbed or striate when dry, sessile or shortly pedicellate; outer operculum shed during bud development, inner operculum finally conical, apiculate or rostrate, sometimes broader than hypanthium, often with strong rubbery cuticle. Stamens white or creamy, inflexed in unopened bud; anthers cuboid/cuneate, dorsi-fixed, versatile, opening by longitudinal slits. Ovary sunk well below rim of hypanthium, (2 or) 3 (or 4)-locular. Style tip usually inserted into pit on underside of operculum or invested by irregular descending tube of tissue; stigma tapered. Ovules in (3–) 4–8 (–10) vertical rows (Fig. 2), with apparent incipient wing on upper side. Ovary chamber with rubbery membrane enveloping whole ovule contents on placenta (Fig. 3). Fruits woody, spherical-truncate, ovoid or urceolate, smooth when fresh, but often ribbed or striate when dry, 8–32 mm long; valves (2 or) 3 (or 4), enclosed; disc broad, descending. Seeds brown, elliptical, lustrous, wingless or with hyaline terminal appendage much shorter than body of seed, many keeled on dorsal side.

The series comprises 12 taxa, 11 of which are endemic to Queensland and one to New South Wales.

Habitat and geographical distribution

All yellow bloodwoods grow on sandy soils which may vary from very shallow to more than a metre deep. Most often, the parent material is sandstone while granite is also common. Rarely, trachyte provides the parent material.

Red bloodwoods also show a preference for sandy soils, but a small proportion of these species is adapted to heavier soils including alkaline clays and soils with poor drainage.

Yellow bloodwoods are distributed on the central coast and nearby ranges of New South Wales, and throughout much of sub-coastal Queensland, often in the vicinity of the Great Dividing Range. These areas experience only a few light frosts each year, or are frost-free.

Annual rainfall varies greatly from a possible excess of 2000 mm experienced by *E. leptoloma* near Paluma in northern Queensland, to a mere 500 mm for *E. leichhardtii* east of Barcaldine in central Queensland.

Ovule patterns in yellow bloodwoods

Apart from bloodwoods, the ovules in eucalypts are arranged on the placenta in an even number of easily-recognized vertical rows. Bilateral symmetry is the pattern, except for some vertical displacement of the ovules in one vertical row to "mesh" with those of a contiguous row (see ovule pattern in *E. pauciflora* in Boland *et al.* 1980). In contrast, this bilateral symmetry is not always seen in both the red and yellow bloodwoods. The ovules in bloodwoods are borne in 3 (rarely), 4, 5, 6, 7 or 8 (rarely 10) vertical rows and there is a rough association between bud size and number of rows. For example, both *E. ptychocarpa* and *E. watsoniana*, the largest-budded species in the red and yellow

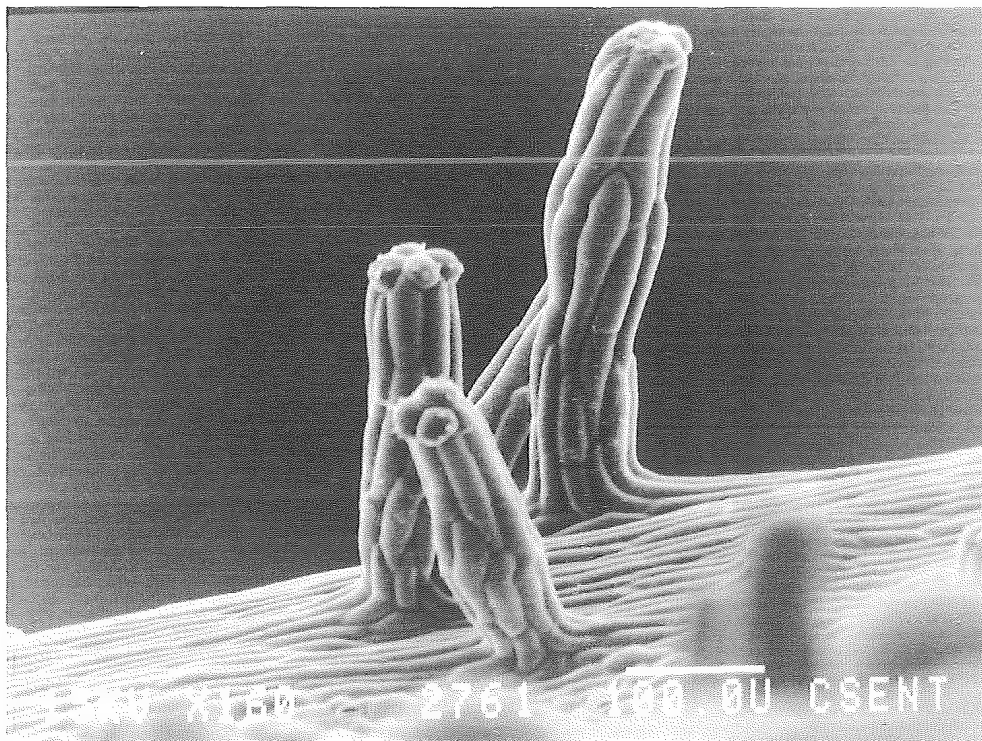


Fig. 1. Trichomes (bristle glands) on juvenile leaves of *E. scabrida* $\times 160$ (seedling of Brooker 4891). These are emergent oil glands with 4 cap cells bearing distinctive papillae (typical of bloodwoods and *Angophora*, Ladiges 1984).

bloodwoods respectively, have up to 8 (rarely 10) rows. Three-rowed placenta have been seen in *E. bunites*, which has the smallest buds of the yellow bloodwoods.

When the row number is odd, the middle row occupies the median vertical line on the placenta, thereby maintaining symmetry. When the number is even, one of the two middle rows occupies the median vertical line and bilateral symmetry is then lost. The ovules of the middle row become keeled (**Fig. 2**), suggesting that pressure causes some distortion during maturation and this character is carried on the mature seedcoat.

The number of rows can vary within a bud and certainly between buds from the same tree. The odd number of vertical rows and the asymmetry in the even-rowed examples appear to be distinctive features of the bloodwoods as it has not been reported elsewhere in the genus.

Juvenile leaves in yellow bloodwoods

There are few *Eucalyptus* series or subseries for which comprehensive seedling studies have been published. Recent examples are the results from investigations of the peppermints (informal *Eucalyptus* subseries *Amygdalininae* by Ladiges *et al.*, 1983), the informal series *Ovatae* (Ladiges *et al.*, 1984), the informal series *Capitellatae* (Ladiges *et al.*, 1986) and the green ashes (Ladiges *et al.*, 1988).

In the *Ovatae* study, the authors refer to the taxonomic problem provided by the similarities in adult plants of related taxa through "continuously varying shape factors". They contrasted this with the much greater dissimilarities occurring in the seedlings of the same species and stated that "the early stages of development are under intense selection pressures and that seedling characters may be the best indicators of evolutionary

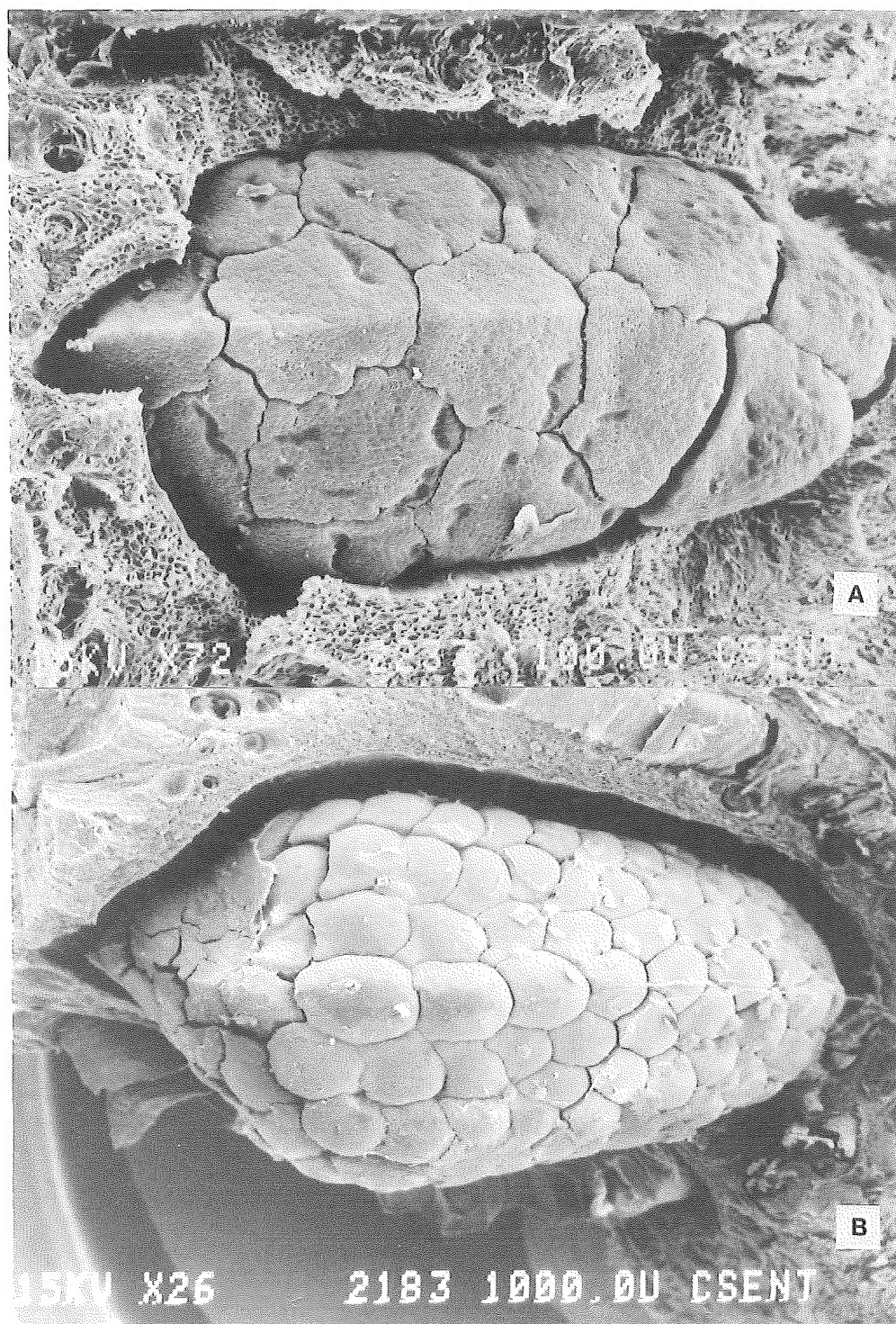


Fig. 2. Ovule patterns in the yellow bloodwoods. A. *E. bunites* $\times 72$. B. *E. watsoniana* subsp. *watsoniana* $\times 26$. A, Boland 1585; B, Brooker 4801.



Fig. 3. Rubbery membrane enveloping placenta and ovules in *E. petalophylla* $\times 48$ (A.R. Bean s.n.).

divergence in ... long-lived ... species". Ladiges *et al.* (1984) cited the advantage of discrete states in assessing a seedling and these are provided in more abundance in the juvenile plant than in the adult. In addition, an advantage in the assessment of glasshouse-grown seedlings is provided by the direct comparisons, node for node, that can be made between taxa.

These aspects of comparative morphology have been notably demonstrated by the yellow bloodwoods. Characters similar to those used by Ladiges *et al.* for their four groups have been seen in the yellow bloodwoods, with the addition of a further distinctive character, peltation in the seedling and juvenile leaves. The presence or absence of peltation and its persistence among only 12 taxa have provided instantly recognizable plant forms such that many of the taxa can be identified from the seedling alone. It is rare for individual species within series to be so distinctive in the juvenile stage as they are in the yellow bloodwoods. Consequently we emphasize the juvenile characters in the species descriptions.

6. Key to species and subspecies of *Eucalyptus* series *Naviculares*

- | | |
|--|---|
| 1. Crown of mature tree with at least some peltate, scabrid leaves | 2 |
| Crown of mature tree composed entirely of smooth, non-peltate leaves | 5 |
| 2. Crown comprising both smooth adult leaves and scabrid juvenile leaves | 3 |
| All of crown comprising scabrid juvenile leaves | 4 |
| 3. Operculum broader than hypanthium, fruits >19 mm long | |
| 8. <i>E. watsoniana</i> subsp. <i>capillata</i> | |
| Operculum same width as hypanthium, fruits 11–14 mm long | |
| 3. <i>E. peltata</i> subsp. <i>dimorpha</i> | |

4. Leaves broadly ovate to orbicular, 6–9 cm wide, petioles >15 mm long . . . 1. *E. peltata* subsp. *peltata*
 Leaves narrowly ovate, 2–4 cm wide, petioles <15 mm long . . . 2. *E. scabrida*
5. Adult and juvenile leaves green, moderately glossy . . . 6
 Adult and juvenile leaves grey-green, dull . . . 9
6. Adult leaves distinctly discolorous . . . 12. *E. leptoloma*
 Adult leaves concolorous . . . 7
7. Fruits <12 mm long . . . 5. *E. bunites*
 Fruits >12 mm long . . . 8
8. Trees growing on skeletal sandstone hills; buds often glaucous; pedicels
 0–2 mm long . . . 11. *E. aureola*
 Trees growing in deep sand on flats and gentle rises; buds never glaucous;
 pedicels 3–6 mm long . . . 10. *E. bloxsomei*
9. Fruits >19 mm long, operculum broader than hypanthium . . . 10
 Fruits <19 mm long, operculum same width as hypanthium . . . 11
10. Juvenile leaves glabrous, non-peltate or <3 pairs peltate . . .
 . . . 7. *E. watsoniana* subsp. *watsoniana*
 Juvenile leaves hairy, >5 pairs markedly peltate . . .
 . . . 8. *E. watsoniana* subsp. *capillata*
11. Seedling with peltate leaves for >10 nodes . . . 12
 Seedling with <3 nodes of, or no peltate leaves . . . 13
12. Adult leaves markedly falcate; fruits 14–18 mm long; NSW only . . . 6. *E. eximia*
 Adult leaves not falcate; fruits 9–15 mm long; Qld only . . . 4. *E. leichhardtii*
13. Adult leaves <25 mm wide with petioles 10–20 mm long; juvenile leaves
 narrowly lanceolate . . . 5. *E. bunites*
 Adult leaves 25–40 mm wide with petioles 20–38 mm long; juvenile
 leaves broadly lanceolate . . . 9. *E. petalophylla*

7. Digests of species*

1. *Eucalyptus peltata* Benth. Fl. austral. 3: 254 (1867). Type: Newcastle Range, Qld., October 1856, *F. Mueller* (holo: K; iso: MEL,NSW).

Eucalyptus peltata Benth. subsp. *peltata*

Small, often gnarled tree, to 7 m high, with golden-yellow rough bark, persistent on trunk and larger branches. Small and medium-sized branches smooth. Seedling leaves remaining opposite for four or five pairs, elliptical. Subsequent leaves alternate, markedly peltate, ovate, bluntly pointed, to 21 × 12 cm. Stems, petioles and laminae very hairy throughout. Leaves on mature trees alternate, peltate, ovate, to 11 × 8 cm, hairy; apex obtuse, mucronate. Petioles to 24 mm long. Peduncles terete or angular, to 20 mm long. Unit inflorescences 7-flowered. Pedicels 0–2 mm long. Buds to 8 × 6 mm; hypanthium glaucous. Fruits ovoid to truncate-spherical, 9–11 × 9–10 mm. Fig. 4A & B.

* denotes seedlings of parent trees grown and studied in glasshouse at CSIRO, Canberra, supplementing field observations

Selected specimens. Queensland. COOK DISTRICT: Newcastle Range, Feb 1928, *Brass* 1774 (CANB); Oak Park, 125 miles [201 km] N of Hughenden, Sep 1937, *Brass & White* 83, (BRI); Conjuboy to Hughenden, Aug 1973, *Brooker* 4139* (CANB). NORTH KENNEDY DISTRICT: Homestead, Oct 1935, *Blake* 9983 (BRI,CANB); 1 mile [1.6 km] N of Hospital Creek, 129 miles [208 km] N of Pentland, Sep 1970, *Turnbull* 44 (CANB); 30 km east of Pentland, Sep 1977, *Blaxell* 1544 & *Armstrong* (CANB,NSW); 14.3 miles [22.9 km] E of Pentland, Aug 1973, *Brooker* 4149 (BRI,CANB,K,NSW); Homestead Creek, 48 miles [76.8 km] W of Charters Towers, Jul 1964, *Larsen* s.n. (CANB); 64 km W of Charters Towers, Dec 1982, *Brooker* 7847* (BRI,CANB).

Distribution and habitat: *E. peltata* subsp. *peltata* is restricted to northern Queensland from Newcastle Range in the north to south of Homestead (Map 1). It grows on sandstone ridges in shallow sandy soils. It is associated with *E. setosa* Schauer, *E. melanophloia* F. Muell. and *E. persistens* L. Johnson & K. Hill.

Flowering period: January – February.

Notes: *E. peltata* subsp. *peltata* could be confused with *E. similis*, which has similar bark, where the two species overlap in their natural distributions but the crown of juvenile leaves in *E. peltata* subsp. *peltata* is immediately distinctive. Rarely do the ultimate shoots produce a short phase of glabrous intermediate leaves and such ontogenetic development is always arrested. The crown in subsp. *peltata* is almost wholly juvenile, while in subsp. *dimorpha* a mixture of adult, intermediate and juvenile leaves is present. The crown of *E. scabrada* also comprises only juvenile leaves but these are narrower than those in *E. peltata* subsp. *peltata*. In addition, *E. scabrada* is an erect tree compared with the gnarled habit of *E. peltata* subsp. *peltata* and has non-glaucous buds.

2. ***Eucalyptus peltata* subsp. *dimorpha* Brooker & A. Bean, subsp. nov. *Eucalypto peltata* Benth. subsp. *peltata* praesentia consistenti foliorum lanceolatorum et peltatorum et non peltatorum in arbore summa, fructibus majoribus, forma arboris superiore et distributione dissimili differt. **Typus:** Queensland. NORTH KENNEDY DISTRICT: 2.2 km N of railway between Laroona and Ewan, 19 May 1989, *M.I.H. Brooker* 10196* (holo: BRI; iso: CANB,DNA,MEL,NSW).**

Tree to 12 m high, usually with erect trunk; bark orangy yellow to orange, persistent except on small branches. Seedling leaves remaining opposite for about five pairs, elliptical. Subsequent leaves alternate, concolorous, markedly peltate, ovate, apex rounded, to 16 × 10 cm. Stems, petioles and leaves very hairy throughout. Leaves on mature trees dull grey-green, concolorous, with both hairy, slightly peltate, and glabrous, non-peltate, lanceolate, acuminate forms, 11–17 × 3–6.1 cm. Petioles terete or flattened, 20–25 mm long. Peduncles 11–25 mm long. Unit inflorescences 7-flowered, rarely more. Pedicels 1–2 mm long. Buds glaucous, to 9 × 6 mm. Operculum low hemispherical. Fruits ovoid to cylindrical, or sometimes slightly urceolate, 12–15 × 10–11 mm. **Fig. 4C & D.**

Specimens examined. Queensland. NORTH KENNEDY DISTRICT: 14.4 km N of "Dotswood", W of Townsville, Jun 1989, *Bean* 1053 (BRI); Ewan–"Laroona" road, just S of Granite Creek, Jun 1989, *Bean* 1061 (BRI); 1 km S of Plumtree Creek on Charters Towers–Clarke R. Road, Sep 1977, *Blaxell* 1556 & *Armstrong* (BRI,NSW); 26 miles [41 km] SW of Mt Garnet, Sep 1937, *Brass & White* 115 (BRI); Tabletop Road, Hervey Range, May 1985, *Brooker* 8994 (BRI,CANB,NSW); 33.3 km from Bruce Highway on tableland at Tabletop, May 1989, *Brooker* 10208* (BRI,CANB,NSW).

Distribution and habitat: The main populations of this subspecies lie west of Townsville in north Queensland along the Herveys Range Development Road, but there are scattered stands further north and west (Map 1). This subspecies occurs in coarse white sandy soil derived from granite. The major associated species are *E. xanthoclada* Brooker & A. Bean, *E. shirleyi* Maiden and *E. crebra* F. Muell.

Flowering period: Unknown.

Etymology: From the Greek *di*, two and *morphe*, form, in reference to the composition of the mature leafy crowns.

Notes: *E. peltata* subsp. *dimorpha* can be distinguished in the field by the large leafy crown comprising a mixture of juvenile, intermediate and adult leaves.

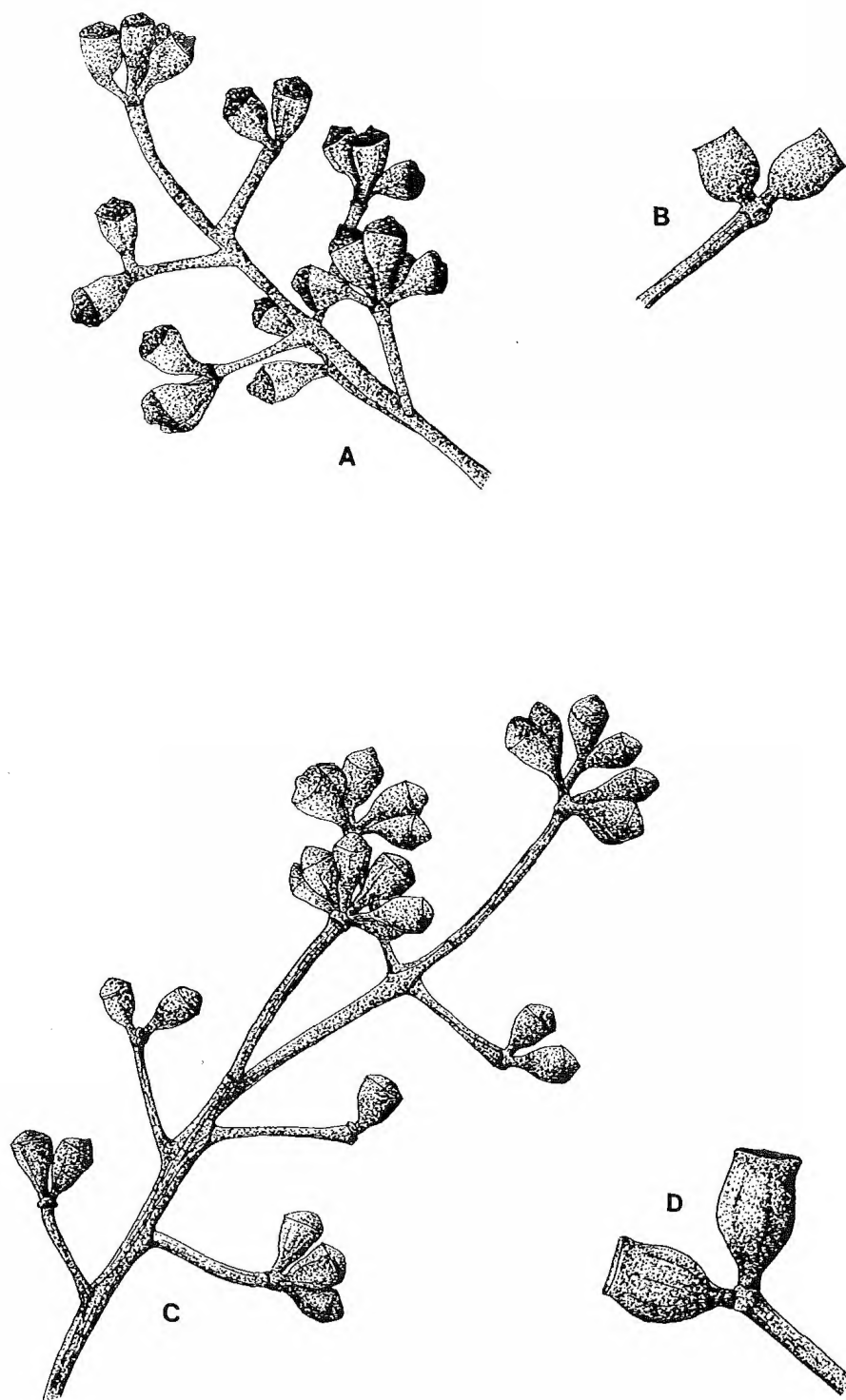


Fig. 4. *E. peltata* subsp. *peltata*: A. buds $\times 1$. B. fruits $\times 1$. *E. peltata* subsp. *dimorpha*: C. buds $\times 1$. D. fruit $\times 1$. A, Brooker 7847; B, Blake 9983; C,D, Brooker 10196.

3. *Eucalyptus scabrida* Brooker and A. Bean, *sp. nov.* *Eucalypto peltata* Benth. affinis a qua foliis totis angustioribus, petiolis brevioribus, alabastris glaucescentem deficientibus et fructibus leviter parvioribus differt. **Typus:** Queensland. LEICHHARDT DISTRICT: 12.5 km from "Mantuan Downs" turn-off towards Springsure on Dawson Developmental Road, 14 October 1987, *M.I.H. Brooker* 9778* (holo: BRI; iso: CANB,MEL,NSW).

Tree to 10 m tall, bark yellow or orange, persistent to smaller branches. Seedling leaves remaining opposite for six pairs, elliptical to ovate, non-peltate; stems, petioles and laminae densely hairy. Subsequent leaves alternate, distinctly peltate, hairy, ovate to lanceolate, apex acute, to 18 × 6 cm, slightly discoloured; petioles to 20 mm long. Leaves on mature trees grey-green, scabrid, peltate, ovate to lanceolate, to 11 × 3.5 cm, concolorous. Petioles almost terete, grooved, to 13 mm long. Peduncles angular, to 24 mm long. Unit inflorescences 7-flowered. Pedicels 1–2 mm long. Buds clavate, non-glaucous, to 9 × 6 mm; operculum low hemispherical, sometimes umbonate. Fruits ovoid to spherical-truncate or urceolate, to 12 × 10 mm. **Figs 1, 5A & B.**

Specimens examined. Queensland. LEICHHARDT DISTRICT: On Tambo road, 80.9 km W of Springsure, Aug 1984, *Bean* 93 (BRI); 80 km from Springsure towards "Tanderra", May 1986, *Bean* 448 (BRI,CANB); 10.8 miles [18 km] from Nandowrie towards Nardoo, Apr 1975, *Brooker* 4891* (BRI,CANB,MEL,NSW); 12.5 km from "Mantuan Downs" turn-off towards Springsure on Dawson Developmental Road, Oct 1987, *Brooker*, 9779, 9780 (CANB); 10.4 km E of "Mantuan Downs" turn-off on the Tambo to Springsure road, Sep 1974, *Kleinig* 194, 196, 197 (CANB).

Distribution and habitat: *E. scabrida* has a restricted distribution in central Queensland, the largest population being near Mantuan Downs station, west of Springsure (**Map 1**). It grows on sandstone ridges in shallow sandy soil. Associated species include *E. melanophloia* F. Muell., *E. dolichocarpa* D. Carr & S. Carr and *Angophora leiocarpa* (L. Johnson ex Leach) Thiele & Ladiges.

Flowering period: October.

Etymology: From the Latin *scabridus*, somewhat scabrous, in reference to the leaves at all stages.

Notes: *E. scabrida* has been confused with *E. peltata* subsp. *peltata* but can be distinguished by the erect habit, narrower leaves of the mature crown, shorter petioles and its non-glaucous buds.

4. *Eucalyptus leichhardtii* Bailey, Qld. Agric. J. 16:493 (1906); *E. peltata* subsp. *leichhardtii* (Bailey) L. Johnson & D. Blaxell, Contrib. N.S.W. Nat. Herb. 4: 453 (1973). **Type:** Queensland, near Alice, Central Railway, December 1905, *W. Pagan* s.n. (holo: BRI; iso: K,MEL,NSW).

Tree, 5–15 m high, with golden or orange yellow bark, persistent on trunk and most branches. Seedling leaves remaining opposite for three pairs, elliptical, hairy, non-peltate. Subsequent leaves hairy, alternate, discoloured, peltate; leaf bases obtuse; apices at first rounded, later distinctly acute. Juvenile leaves peltate, acute, grey-green, slightly discoloured, hairy, ovate to deltoid, to 14.2 × 7.2 cm, becoming broadly lanceolate, to 21 × 6 cm; petioles and stems also hairy. Adult leaves lanceolate or narrowly lanceolate, to 19 × 3.8 cm, grey-green, concolorous; petioles 12–26 mm long, flattened. Peduncles to 18 mm long. Unit inflorescences 7-flowered. Pedicels 0–2 mm long. Buds 9–11 × 6–7 mm, hypanthium often glaucous, especially in northern Queensland. Operculum low hemispheric, umbonate. Fruits ovoid to urceolate, 9–15 × 8–13 mm. **Figs. 5C & D, 6.**

Selected specimens. Queensland. COOK DISTRICT: Mt Mulligan, Apr 1987, *Clarkson* 6916 (BRI,CANB,MBA,MEL,NSW,QRS); Mutchilba-Stannary Hills road, May 1971, *Hyland* 5072 (CANB,QRS); 2 miles [3.2 km] west of Lappa, Aug 1966, *Larsen* 606 (CANB); Watsonville-Bakerville road, Oct 1971, *Hyland* 5586 (BRI,CANB); between Watsonville and Bakerville, Jan 1972, *Brooker* 3355 (BRI,CANB,DNA,NSW,QRS); c. 1 km N of Chinaman Creek crossing on Watsonville road, Oct 1979, *Brooker* 6518, 6519* (CANB). NORTH KENNEDY DISTRICT: 7.4 miles [11.8 km] S of Mt Garnet, Nov 1971, *Kleinig* 1*, 3 (CANB); Mt Claro, W of Ingham, Jun 1966, *Walker* ANU366 (CANB); range before Hidden Valley, 19.8 km W of Paluma, May 1989, *Brooker* 10205* (BRI,CANB,DNA,MEL,NSW); 60 km N of Pentland to Wando Vale, Sep 1977, *Blaxell* 1554 & *Armstrong* (CANB,NSW); White Mountains, Torrens Creek catchment, May 1985, *Brooker* 8973 (CANB). SOUTH KENNEDY DISTRICT: c.22 km NNW of Yarrowmire Station, Oct 1983, *Henderson* 2861 (BRI,CANB); near junction of Bowen and Burdekin Rivers, Oct 1958, *Blake* 18691 (BRI,CANB); 32 km W of Alpha, May 1989, *Brooker* 10217*, 10218 (BRI,CANB,DNA,NSW). MITCHELL DISTRICT: Capricorn Highway, 3 km E of Alice Railway Siding, Jul 1989, *Bean* 1095 (BRI). LEICHHARDT DISTRICT: 47.4 km from Clermont towards Alpha, May 1989, *Brooker* 10214* (BRI,CANB,DNA,NSW); 26.5 km W of Springsure on Tambo road, Oct 1987, *Brooker* 9782* (CANB); Salvator Rosa NP, 170 km SW of Springsure, Sep 1987, *Thomas* 242 (BRI).

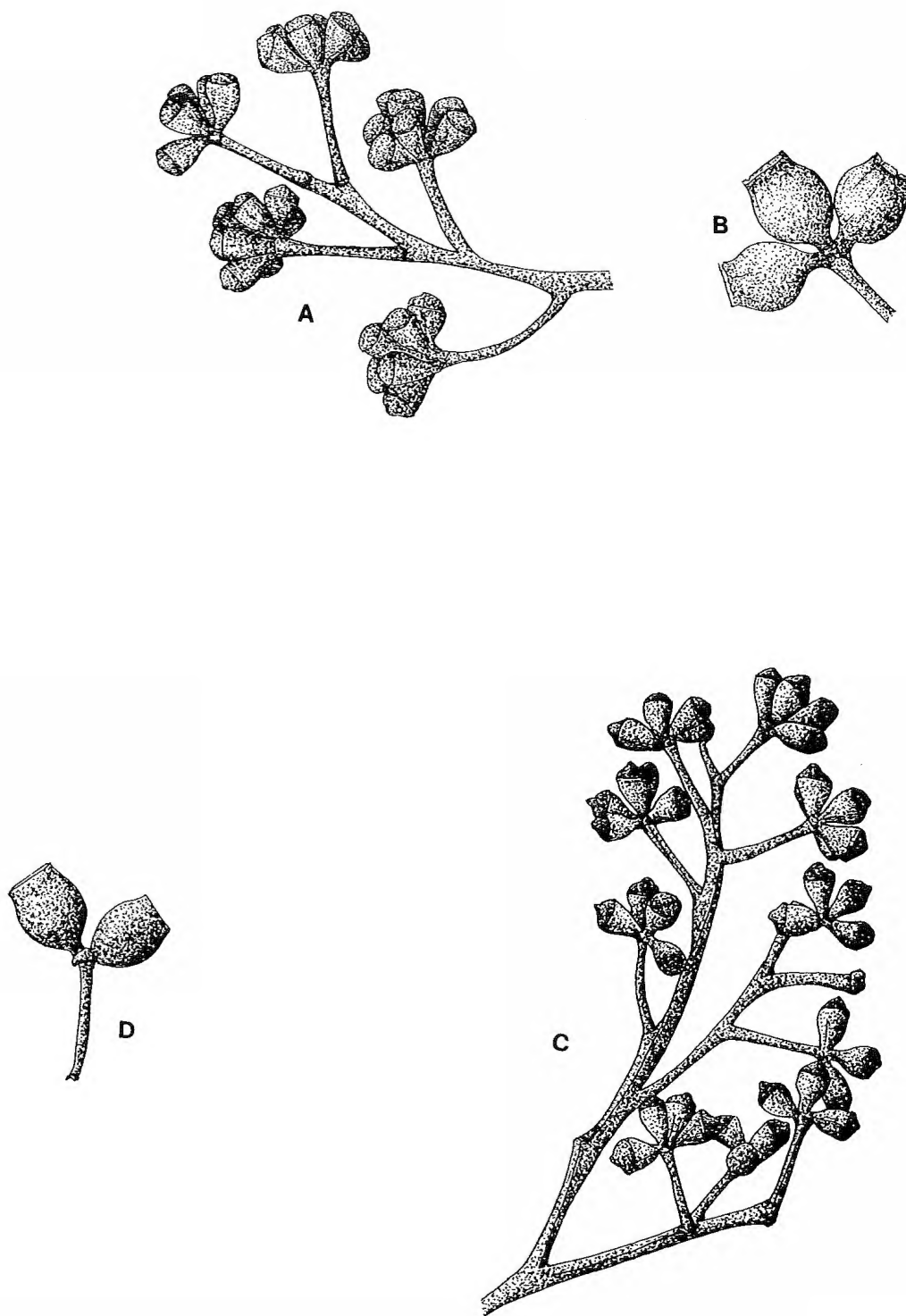


Fig. 5. *E. scabrida*: A. buds $\times 1$. B. fruits $\times 1$. *E. leichhardtii*: C. buds $\times 1$. D. fruit $\times 1$. A,B, Brooker 9778; C, Hyland 5586; D, Kleinig 3.

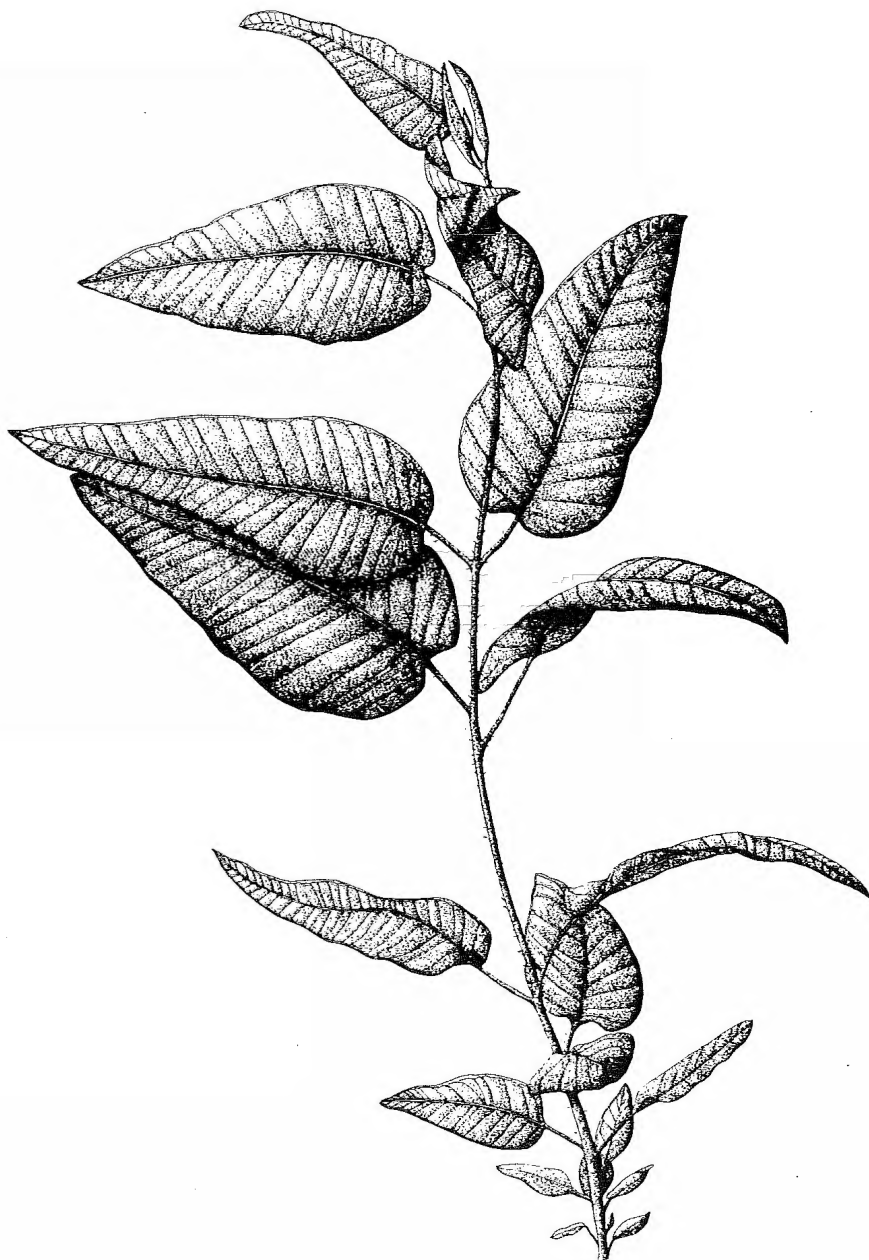


Fig. 6. *E. leichhardtii*: from seedling of Brooker 10217 $\times 0.4$.

Distribution and habitat: This species is distributed sporadically over a wide area of central and northern Queensland, ranging from Salvator Rosa National Park to Mt Mulligan (Map 1). It grows on sandstone ridges and hills, or on sandy soils over sandstone. There are many eucalypt species associated with *E. leichhardtii* throughout its range including *E. citriodora* Hook. and *E. brachycarpa* D. Carr & S. Carr.

Flowering period: January – March.

Notes: *E. leichhardtii* is a distinctive species, and no closer to *E. peltata* subsp. *peltata* with which it has frequently been associated taxonomically than to other species, e.g. *E. aureola*. In its fragmented distribution it is not sympatric with *E. peltata* subsp. *peltata*.

5. *Eucalyptus bunites* Brooker & A. Bean, sp. nov. *Eucalypto leichhardtii* Bailey affinis a qua foliis plantularum angustis non peltatis, foliis adultis saepe angustioribus, hypanthiis glaucadinem deficientibus et fructibus saepe subsphaericis differt. **Typus:** Queensland, LEICHHARDT DISTRICT: Blackdown Tableland, Queensland, 31 August 1972, M.I.H. Brooker 3779* (holo: BRI; iso: CANB,K,MEL,NSW).

Tree with erect trunk, 5–18 m high. Bark orangy to orangy-brown, persistent except on smallest branches. Seedling leaves remaining opposite for about six pairs, elliptical to lanceolate, to 8.5×2.7 cm. Stems, petioles and laminae hispid. Juvenile leaves alternate, lanceolate to narrowly lanceolate, never peltate, bright green (northern population) or grey-green (southern population), to 22×5 cm, slightly discolorous; apex acute to acuminate. Stems, petioles and laminae glabrous. Adult leaves narrowly lanceolate or falcate, to 15.0×2.5 cm, concolorous, acuminate; green and slightly glossy in northern population, dull grey-green in southern population. Petioles 10–20 mm long, distinctly flattened, up to 2 mm wide. Peduncles angular, to 20 mm long. Unit inflorescences 7-flowered. Pedicels 1–2 mm long. Buds clavate, to 7×5 mm. Operculum low hemispheric, umbonate. Hypanthium not glaucous. Fruits truncate-spherical, sometimes ovoid, 9–12 $\times$ 9–11 mm. **Figs 2A, 7 & 8.**

Specimens examined. Queensland, LEICHHARDT DISTRICT: 1 km along Oilbore road, towards Robinson Gorge, Sep 1985, *Bean* 275 (BRI,NSW); Blackdown Tableland, 21.4 km in from Umolo railway siding, Apr 1979, *Boland* 1585* (CANB); Blackdown Tableland, gate, Sep 1972, *Brooker* 3782 (BRI,CANB,K); 0.4 km S of gate to Blackdown Tableland, Apr 1975, *Brooker* 4814 (AD,BRI,CANB,MEL,NSW); 61 miles [100 km] south of Bauhinia Downs towards Taroom, Apr 1975, *Brooker* 4839* (AD,BRI,CANB,MEL,NSW); northern slope of Blackdown Tableland, on entrance road, Mar 1982, *Brooker* 7375* (BRI,CANB,NSW); road to Stony Falls, Blackdown Tableland, Mar 1982, *Brooker* 7382* (BRI,CANB,NSW); NW of Horseshoe Lookout, Blackdown Tableland, Mar 1982, *Brooker* 7386 (BRI,CANB,NSW); approach to Blackdown Tableland, May 1989, *Brooker* 10224 (BRI,CANB,DNA,NSW); Blackdown Tableland, track to east opposite Loop road, Mar 1990, *Brooker* 10453* (BRI,CANB,MEL,NSW); at gate to Blackdown Tableland S.F., Sep 1974; *Chippendale* 1110, 1112 (AD,BRI,CANB,MEL,NSW,PERTH); Blackdown Tableland, Apr 1973, *Cossalter* 627 (CANB); 32 miles SW of Daringa, Aug 1970, *Turnbull* 12 (CANB).

Distribution and habitat: *E. bunites* has a restricted distribution in central Queensland (**Map 3**). It is best known from the Blackdown Tableland, and most collections have been made from there but it also grows in the Robinson Gorge area, about 150 km further south. It occurs on sandstone hills and ridges in shallow sandy soil. Associated species include *E. sphaerocarpa* L. Johnson & Blaxell, *E. baileyana* F. Muell., *E. sp. aff. E. umbra* R. Baker and *Angophora leiocarpa* (Johnson ex Leach) Thiele & Ladiges.

Flowering period: July – September.

Etymology: From the Latinised Greek *bounites*, hill dweller, in reference to the common habitat for the species.

Notes: *E. bunites* has been collected on the Blackdown Tableland for some years but its identity has been confused, often being attributed to *E. leichhardtii*. Seedling trials revealed a taxon unlike any other in the series because of its long, narrow, non-peltate seedling and juvenile leaves. Its distribution is disjunct with the forms at the two sites showing juvenile leaf differences as shown above.

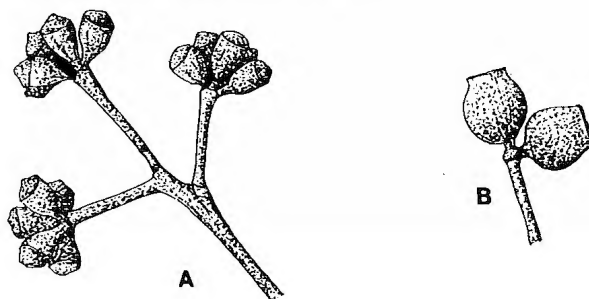


Fig. 7. *E. bunites*: A. buds $\times 1$. B. fruit $\times 1$. A, Brooker 7386; B, Brooker 3782.

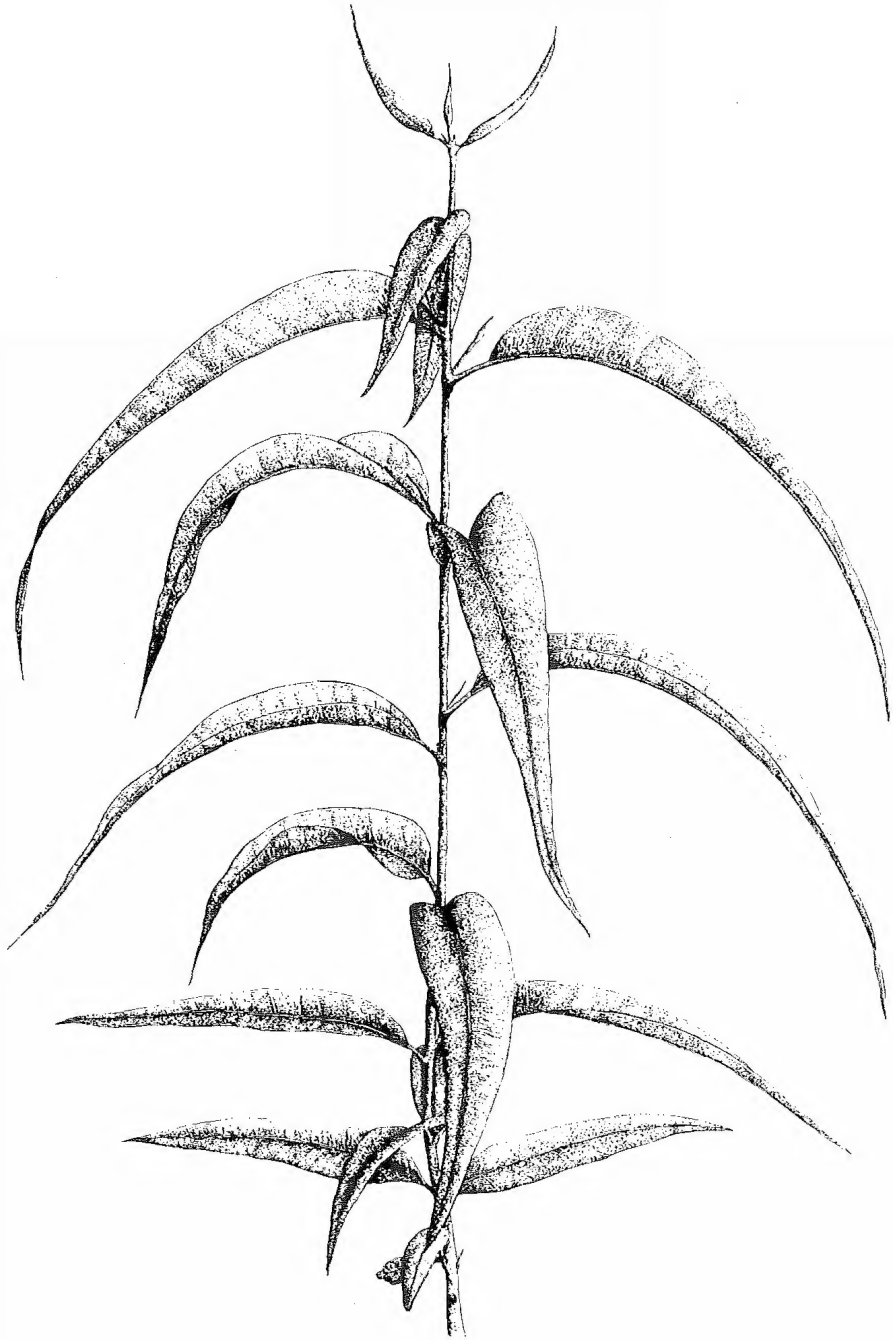
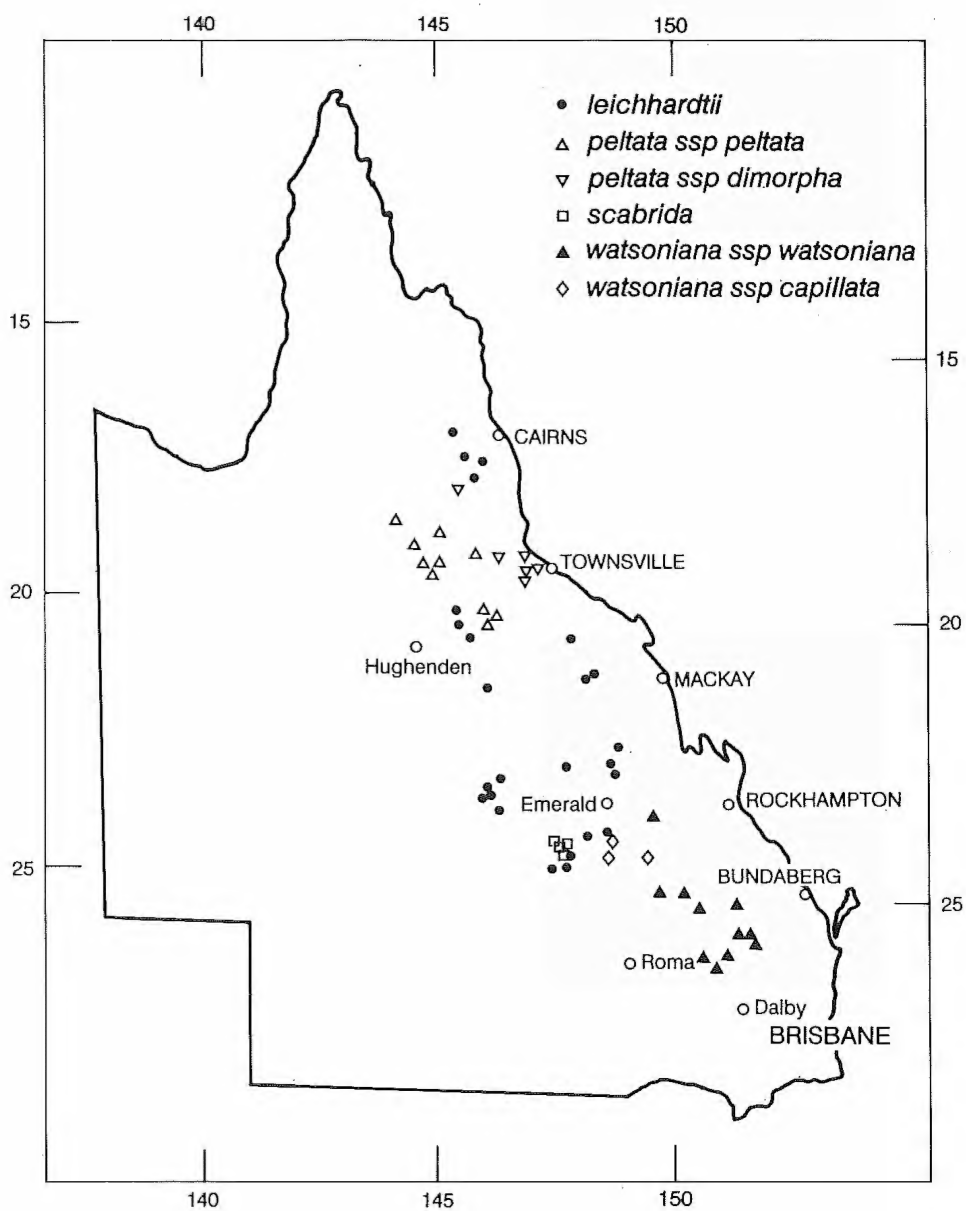


Fig. 8. *E. bunites*. from seedling of Brooker 10224 $\times 0.4$.



Map 1. Distribution of *E. peltata* subsp. *peltata*; *E. peltata* subsp. *dimorpha*; *E. scabrida*; *E. leichhardtii*; *E. watsoniana* subsp. *watsoniana*; *E. watsoniana* subsp. *capillata*.

6. *Eucalyptus eximia* Schauer in W.G. Walpers, Repert. Bot. Syst. 2: 925 (1843). **Type:** New South Wales, Banks of Grose R., 9–10 November 1803, R. Brown & F. Bauer s.n. (holo: W; iso: BM,E,K,MEL,NSW).

Tree to 15 m high. Bark brownish yellow, persistent except on small branches. Seedling leaves remaining opposite for three pairs, elliptical, peltate from second pair onwards. Juvenile leaves alternate, concave, very conspicuously peltate, hairs on stems, petioles and leaves short and bristly, to 16×9 cm, grey-green. Adult leaves falcate, to 21×2.8 cm, grey-green, concolorous. Coppice leaves also falcate, but larger, up to 27×5.2 cm, acuminate. Petioles flattened, 15–27 mm long. Peduncles flattened, up to 35 mm long. Unit inflorescences 7-flowered. Pedicels 0–2 mm long. Buds clavate, to 12×9 mm. Operculum rostrate, distinctly umbonate. Fruits ovoid, $14\text{--}18 \times 12\text{--}15$ mm, sessile or very shortly pedicellate. **Fig. 9A & B.**

Specimens examined: New South Wales. Maroota, Dec 1930, *de Beuzeville* 29 (CANB); Cowan, Dec 1931, *de Beuzeville* 374–377 (CANB,NSW); St Albans, towards Wollombi, Feb 1979, *Briggs* 335 (CANB); between Hawkesbury River and Woy Woy, Nov 1970, *Brooker* 2842 (BRI,CANB,MEL); plateau east of Picton Lake, Nov 1974, *Brooker* 4616 (BRI,CANB,MEL,NSW); shoulder, N end of Broken Back Range, WNW of Pokolbin, Jun 1976, *Brooker* 5152 (AD,BRI,CANB,MEL,NSW); Howe's Mtn, Aug 1963, *Burgess* (seed 631931) (CANB,CBG); near Mitchell Pass lookout, Blue Mtns ascent, Apr 1962, *Burgess* (seed 62889) (CANB,CBG); Emu Plains, Jan 1900, *Cabbage* (CANB); Sawyer's Gully, Maitland, Dec 1901, *Cabbage* (CANB); Blaxland Park, Blaxland, Apr 1975, *Chippendale* 1194 & *Brennan* (AD,BRI,CANB,MEL,NSW,PERTH); Hawkin's Lookout near Wiseman's Ferry, Sep 1984, *Coveny* 11907 (CANB,NSW); 83 miles [138 km] from Windsor, May 1968, *Dunlop* 115 (CANB,CBG); Luddenham, Feb 1968, *Hall* (CANB); Glenbrook RAAF Station, Nov 1965, *Johnston & Vos* (CANB); 1.9 km W of Warrimoo towards Springwood, Jul 1974, *Kleinig* 133 (CANB); between Colo Heights and Colo River, Sep 1966, *Phillips* (CANB,CBG); Yalwal road, Aug 1988, *Slee* 2253* (BRI,CANB,NSW); Putty road, Oct 1988, *Slee* 2363* (BRI,CANB,NSW);

Distribution and habitat: *E. eximia* is endemic in New South Wales and extends from Pokolbin to Nowra (**Map 2**). It is most common around Sydney and the lower Blue Mountains, growing on shallow sandy soils on the Hawkesbury sandstone. It grows with *E. gummifera* (Gaertner) Hochr., *E. punctata* DC. and *Angophora costata* (Gaertner) Britten.

Flowering period: September – November.

Notes: *E. eximia* is quite disjunct from other members of series *Naviculares*. It is notable for the large curved adult leaves, broad juvenile leaves peltate for many nodes and the relatively large fruit.

7. *Eucalyptus watsoniana* F. Muell. Fragm. 10: 98 (1876). **Type:** Wigton, Queensland, in 1876, T.W. Watson s.n. (holo: MEL; iso: K).

Eucalyptus watsoniana F. Muell. subsp. *watsoniana*

Tree to 18 m high; bark bright orangy yellow to brownish yellow. Seedling leaves remaining opposite for three pairs, hairy. Subsequent leaves alternate, glabrous. Stems and petioles also glabrous beyond this point. Very few or no leaves peltate. Juvenile leaves broadly lanceolate, base obtuse, apex acute, to 22×10 cm, grey-green, concolorous. Adult leaves lanceolate, $14\text{--}18 \times 2.5\text{--}4.5$ cm, grey-green, concolorous. Petioles to 27 mm long, flattened. Peduncles angular or terete, to 28 mm long. Unit inflorescences 7-flowered. Pedicels to 12 mm long. Buds to 19×16 mm, operculum flat, umbonate, broader than hypanthium. Fruits ovoid to urceolate, $21\text{--}32 \times 18\text{--}24$ mm, pedicels 5–14 mm long. **Figs 2B, 9C & D.**

Selected specimens. Queensland. LEICHHARDT DISTRICT: Isla Gorge, Mar 1990, *Bean* 1426* (BRI,CANB); 55 km from Taroom-Theodore road towards Glenhaughton, Mar 1982, *Brooker* 7334 (BRI,CANB,NSW); 38 miles [62 km] N of Taroom towards Theodore, Apr 1975, *Brooker* 4801 (BRI,CANB); 40 km SSE of Theodore, vicinity of Isla Gorge, Jan 1977, *Guymer* 863 (CANB,NE); c. 11 km N of "Jamberoo" Station, N of Taroom, May 1976, *Martensz* 975 (BRI,CANB,MEL,NSW); 60 km W of Theodore, Aug 1976, *Martensz* 1001 (BRI,CANB); 4.5 km S of Fairyland, S of Cracow, May 1985, *Brooker* 9000* (CANB). BURNETT DISTRICT: Auburn Range, S of "Rockybar", Mar 1990, *Bean* 1429* (BRI,CANB); Portion 7, Parish of Chesborough, 18 road miles [29 km] from Mundubbera, Aug 1971, *Brooker* 3757, 3758 (BRI,CANB,NSW). DARLING DOWNS DISTRICT: Barakula, Apr 1975, *Brooker* 4779 (AD,BRI,CANB,MEL,NSW); Ballon S.F., Jun 1959, *Johnson* [NSW 132493] (CANB,NSW); north of Jandowae on road to Fairyland, Sep 1970, *Hall* s.n. (CANB); 9.3 km N of Barakula Forest Office, Sep 1974, *Chippendale* 1082 (BRI,CANB).

Distribution and habitat: This taxon occurs in southern Queensland (**Map 1**). The type locality, Wigton, is at the eastern extremity of its distribution, and it extends west to the Robinson Gorge area and north to the Blackdown Tableland. It grows on sandstone

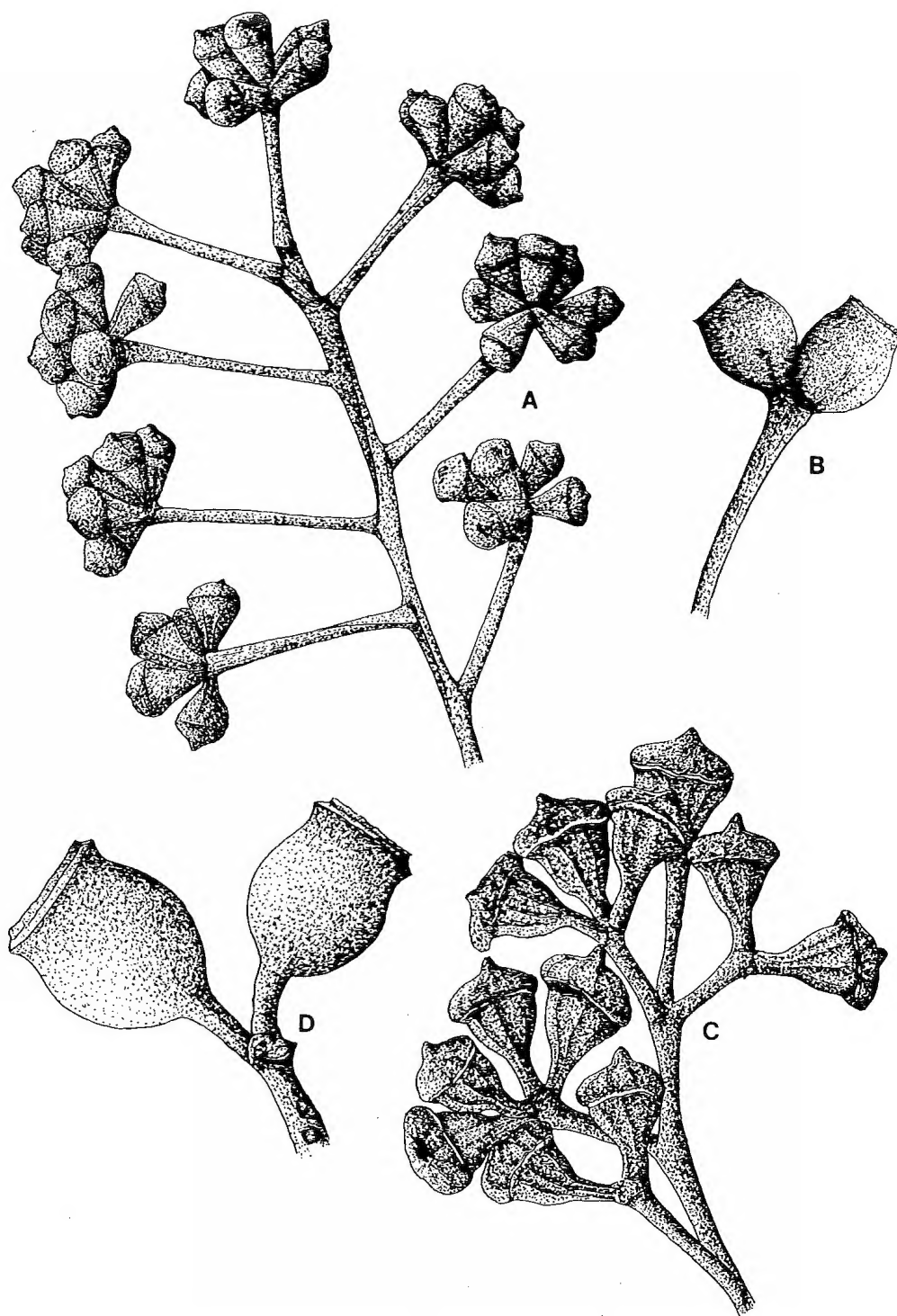


Fig. 9. *E. eximia*: A. buds $\times 1$. B. fruit $\times 1$. *E. watsoniana* subsp. *watsoniana*: C. buds $\times 1$. D. fruit $\times 1$. Subsp. *capillata* differs only slightly in size. A,B, Coveny 11907; C, Martensz 1001; D, Chippendale 1082.

ridges on shallow sandy soils. It is often associated with *E. tenuipes* (Maiden & Blakely) Blakely & C. White, *E. maculata* Hook. and *E. suffulgens* L. Johnson & K. Hill.

Flowering period: June – September.

Notes: *E. watsoniana* subsp. *watsoniana* is characterised by broad, dull adult leaves and few or no peltate seedling leaves. The fruits, which are up to 32 mm long, are the largest found in the series.

8. *Eucalyptus watsoniana* F. Muell. subsp. *capillata* Brooker & A. Bean, subsp. nov. A subspecies typica plantulis pubescentibus, foliis valde peltatis, foliis adultis latioribus, petiolis brevioribus, et fructibus aliquantum parvioribus differt. **Typus:** Queensland. LEICHHARDT DISTRICT: 30.4 miles [50 km] E of Rolleston in Expedition Range, Queensland, 23 April 1975, *M.I.H. Brooker* 4833* (holo: BRI; iso: AD,CANB,MEL,NSW).

Tree to 13 m high, bark yellow to brownish yellow, persistent except on small branches. Seedling leaves remaining opposite for two to about five pairs, first three pairs not peltate; all subsequent leaves markedly peltate; stems and petioles hairy although upper seedling leaves hairy only on major veins. Juvenile leaves concolorous, dull, blue-green, 15–20 × 7–12 cm, leaves becoming glabrous by 10th node; stems hairy to about 15th node. Scabrid, peltate leaves may persist on crown of mature tree. Adult leaves lanceolate to broadly lanceolate, 12–16 × 4.1–6.1 cm, grey-green, concolorous, glabrous, non-peltate. Petioles to 25 mm long, flattened. Peduncles up to 40 mm long, terete or angular. Unit inflorescences 7-flowered. Pedicels 0–6 (9) mm long. Buds 17–20 × 13–15 mm. Operculum broader than hypanthium, apiculate. Fruits ovoid to cylindrical or urceolate, 20–25 × 18–20 mm. **Fig. 9C & D.**

Specimens examined. Queensland. LEICHHARDT DISTRICT: 23.4 km from Springsure towards Rolleston, Apr 1979, *Boland* 1569* (CANB); 61 miles [99 km] south of Emerald (between Springsure and Rolleston), Jul 1968, *Brooker* 1446 (CANB,GAUBA); 14.2 miles [24 km] from Springsure towards Rolleston, Apr 1975, *Brooker* 4829* (AD,BRI,CANB,MEL,NSW); Expedition Range, Dawson Highway, 28 km W of Bauhinia Downs, Mar 1982, *Brooker* 7353 (BRI,CANB,NSW); W of Coynes Bore, Mar 1990, *Brooker* 10447 (CANB); between Bauhinia Downs and Rolleston, Mar 1990, *Brooker* 10448 (CANB); 14 miles [23 km] W of Bauhinia Downs, Aug 1962, *Johnson* 2468 & *Everist* (BRI,CANB); 23 miles [38 km] WSW of Rolleston, Aug 1961, *Lazarides & Story* (CANB); c. 5.5 km W of Coynes Bore road to Mt Ogg on Mt Inglis Holding, Aug 1976, *Martensz* 1084* (CANB); 25 km S of Springsure towards Rolleston, Aug 1975, *W. McCreddie* Tree 12 (CANB).

Distribution and habitat: This subspecies is confined to central Queensland, on the Expedition and Staircase Ranges, east and west of Rolleston respectively (**Map 1**). It grows in shallow sandy soil on sandstone hillsides and ridges. At the northern end of the Staircase Range, there is intergradation between this subspecies and *E. leichhardtii*.

Flowering period: November.

Etymology: From the Latin *capillatus*, hairy, in reference to the seedlings.

Notes: The subspecies is distinguished from *E. watsoniana* subsp. *watsoniana* by its persistent peltate juvenile leaves, somewhat smaller fruits, shorter pedicels and the operculum which is only slightly broader than the hypanthium.

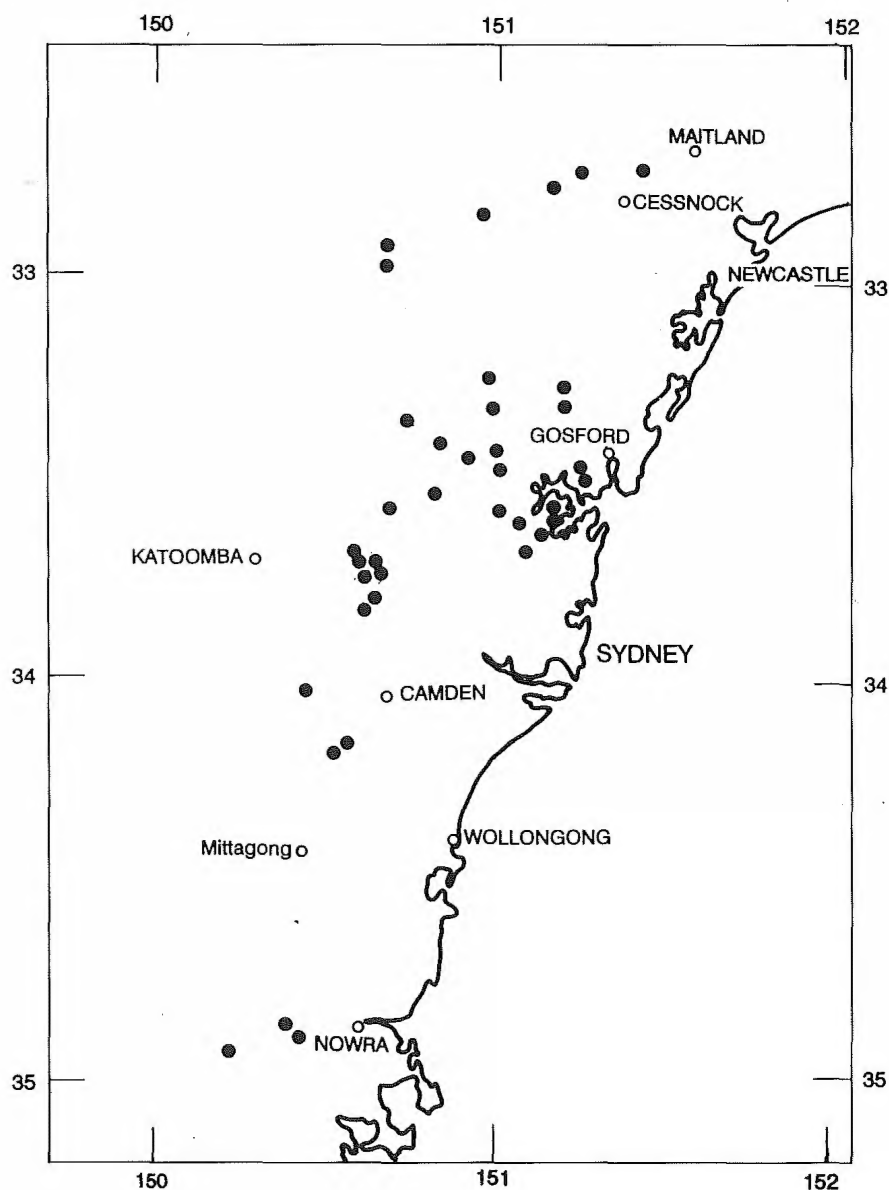
9. *Eucalyptus petalophylla* Brooker & A. Bean, sp. nov. *Eucalypto watsonianae* F. Muell. affinis a qua alabastris parvioribus, operculo latitudinem hypanthii aequanti et fructibus multo parvioribus differt. **Typus:** Queensland. BURNETT DISTRICT: Beeron Holding, 5 km W of "Toondahra" homestead, (25°59'S, 151°21'E), 9 September 1989, *A.R. Bean* 1112 & *P.I. Forster* (holo: BRI, iso: A,DNA,HO,MEL,NSW,PERTH,CANB,QRS).

Tree to 13 m high, often of poor form, bark orangy or orangy brown. Smallest branches smooth. Seedling leaves remaining opposite for three pairs, elliptical, base obtuse or slightly cordate. Leaves, petioles and stems hairy. Next four leaves alternate, peltate, after which all leaves non-peltate. Stems, petioles and laminae glabrous from midway through the peltate stage. Juvenile leaves ovate to broadly lanceolate, concolorous, to 25 × 10 cm, grey-green, petioles to 22 mm long. Adult leaves lanceolate, 15.5–19 × 2.5–4.0 cm, dull grey-green, concolorous. Petioles 20–38 mm long, markedly flattened (up to 2 mm wide). Peduncles to 28 mm long. Unit inflorescences usually 7-flowered, but occasionally up to 21-flowered. Pedicels 1–4 mm long. Buds to 7 × 4 mm, clavate,

operculum low hemispheric with a blunt point, not wider than hypanthium. Fruits ovoid to truncate-spherical, $8-14 \times 8-12$ mm. Figs 3, 10A & B.

Specimens examined. Queensland, BURNETT DISTRICT: Eidsvold District, *Bancroft* [AQ 131525] (BRI); southern end of "Munboree" Station, SW of Gayndah, Apr 1985, *Bean* 149 (BRI); 20 km W of Eidsvold, Jul 1989, *Bean* 1102, 1104 (BRI); "Munboree" Station, via Gayndah, Oct 1987, *Brooker* 9763*, 9764, 9765 (BRI, CANB); Mt Lorna Summit, 3.5 km W of "Toondahra" homestead, Sep 1985, *Forster* 2238 (BRI); 15 km WSW of Eidsvold, Jul 1981, *Vandersee* [AQ 345766] (BRI).

Distribution and habitat: This species is confined to the Burnett district of south-eastern Queensland (Map 3). There are two known populations, both sizeable, and both growing on skeletal soils derived from granite. Associated species include *E. baileyana* F. Muell., *E. trachyphloia* F. Muell. and *E. watsoniana* F. Muell.



Map 2. Distribution of *E. eximia*.

Flowering period: July – September.

Etymology: From the Greek *petalos*, broad and *phyllon*, leaf, in reference to the large juvenile leaves.

Notes: *E. petalophylla* is unusual in the yellow bloodwoods with its clear disjunction in distribution. It is notable for the short peltate-leaf phase and the relatively large leaves at all stages of growth.

- 10. *Eucalyptus bloxsomei* Maiden, J. & Proc. Roy. Soc. New South Wales 59: 156 (1925).**
Type: Hippong, Queensland, 1919, April 1922, June 1922, 10 October 1922, February 1923, March 1925, *H.S. Bloxsome* s.n. (syn: BRI (April 1922, March 1925), NSW).

Tree to 22 m tall with bright golden-yellow bark on trunk and most branches. Small branches smooth-barked. Seedling leaves remaining opposite for about four pairs, elliptical, to 42 × 22 mm. Stems, petioles and laminae hairy. A few subsequent leaves (about five) barely peltate, green, ovate to broadly lanceolate, to 14 × 6 cm. Juvenile leaves non-peltate, discolorous, becoming somewhat glossy green, apex acute, base obtuse, a few hairs persisting on stems, petioles and leaf midribs. Adult leaves lanceolate or narrowly lanceolate, to 18 × 3 cm, bright glossy green, concolorous. Petioles flattened, to 25 mm long. Peduncles up to 18 mm long. Unit inflorescences mostly 7-flowered, occasionally up to 11-flowered. Pedicels 3–6 mm long. Buds ovoid, up to 10 × 6 mm. Operculum apiculate or beaked. Hypanthium not glaucous. Fruits ovoid or urceolate, 14–16 × 10–13 mm. **Fig. 10C & D.**

Selected specimens. Queensland. LEICHHARDT DISTRICT: 20 miles [32 km] S of Wandoan, Apr 1964, Speck 1973, 1974 (BRI,CANB). BURNETT DISTRICT: Myola Road, between Wee Wee Creek and Myola, Aug 1985, *Bean* 265 (BRI); 27.9 miles [44.6 km] from Mundubbera towards Chinchilla, Aug 1972, *Brooker* 3760 (BRI,CANB,K,NSW); S of Mundubbera on road to Boondooma, Dec 1944, *Shaw* 5118 (CANB). DARLING DOWNS DISTRICT: Welsh's Road, 5.2 km from Leichhardt Highway, Oct 1987, *Brooker* 9791* (BRI,CANB); c. 50 km NNE of Chinchilla near Durah homestead, May 1971, *Johnson* 7089 & *Briggs* (CANB,NSW); 9.6 km N of Barakula Forest Office, Sep 1974, *Chippendale* 1081 (CANB); NE of Burncluth, Aug 1968, *Brooker* 1508, 9 (CANB,GAUBA); Ballon State Forest reserve, Mar 1953, *Blake* 19170 (BRI,CANB); 3.3 miles [5.3 km] from Fairyland corner on Mundubbera road, S of Ballon, Apr 1975, *Brooker* 4776* (AD,BRI,CANB,MEL,NSW); 6 km W of turn-off to Chinchilla from intersection N of Jandowae, Mar 1982, *Brooker* 7311 (BRI,CANB,NSW).

Distribution and habitat: *E. bloxsomei* has a restricted distribution in southern Queensland between Chinchilla and Mundubbera, and centred on the Barakula State Forest (**Map 3**). It grows in moderate to deep sandy soils in country of low relief. Commonly associated species include *E. chloroclada* (Blakely) L. Johnson & K. Hill, *Angophora leiocarpa* (Johnson ex Leach) Thiele & Ladiges and *E. maculata* Hook.

Flowering period: June – August.

Notes: *E. bloxsomei* is notable for the bright glossy green adult leaves, a character it shares with *E. aureola* and *E. leptoloma* in the yellow bloodwoods. The type locality, Hippong, lies within the Barakula State Forest.

- 11. *Eucalyptus aureola* Brooker & A. Bean, sp. nov. *Eucalypto bloxsomei* Maiden affinis a qua foliis plantularum peltatis per nodos multos, foliis adultis angustioribus, alabastris glaucis, pedicellis brevioribus et habitatione dissimili differt. Typus:**
Queensland. LEICHHARDT DISTRICT: hills W of Lake Elphinstone, Carborough Range, 20 May 1989, *M.I.H. Brooker* 10212* (holo: BRI; iso: CANB,NSW).

Tree to 14 m tall, with bright golden-yellow bark on trunk and most branches. Small branches smooth-barked. Seedling leaves remaining opposite or sub-opposite for about ten pairs, broadly ovate. First three or four pairs not peltate; subsequent leaves all peltate, with obtuse or cordate base. Stems, petioles and leaf veins hairy. Juvenile leaves alternate, lanceolate, to 28 × 7 cm, glossy-green on upper surface. Adult leaves narrowly lanceolate or falcate, up to 18 × 2.4 cm, bright green, concolorous. Petioles terete or flattened, up to 25 mm long. Peduncles to 17 mm long. Unit inflorescences 7-flowered. Pedicels 0–2 mm long. Buds clavate, to 11 × 7 mm, often glaucous. Operculum low hemispheric. Fruits ovoid, cylindrical or urceolate, 14–18 × 11–16 mm. **Fig. 10E & F.**

Specimens examined. Queensland. LEICHHARDT DISTRICT: Hills beside Lake Elphinstone, Jun 1989, *Bean* 1043 (BRI); 84 km E of Clermont towards Mackay, Jul 1976, *Brooker* 5329*, 5330* (CANB); 0.5 km S of Lake Elphinstone in the Carborough Range, Aug 1976, *Martensz* 1096* (BRI,CANB); Cherwell Range, Aug 1986, *Bean* 502 (BRI,CANB).

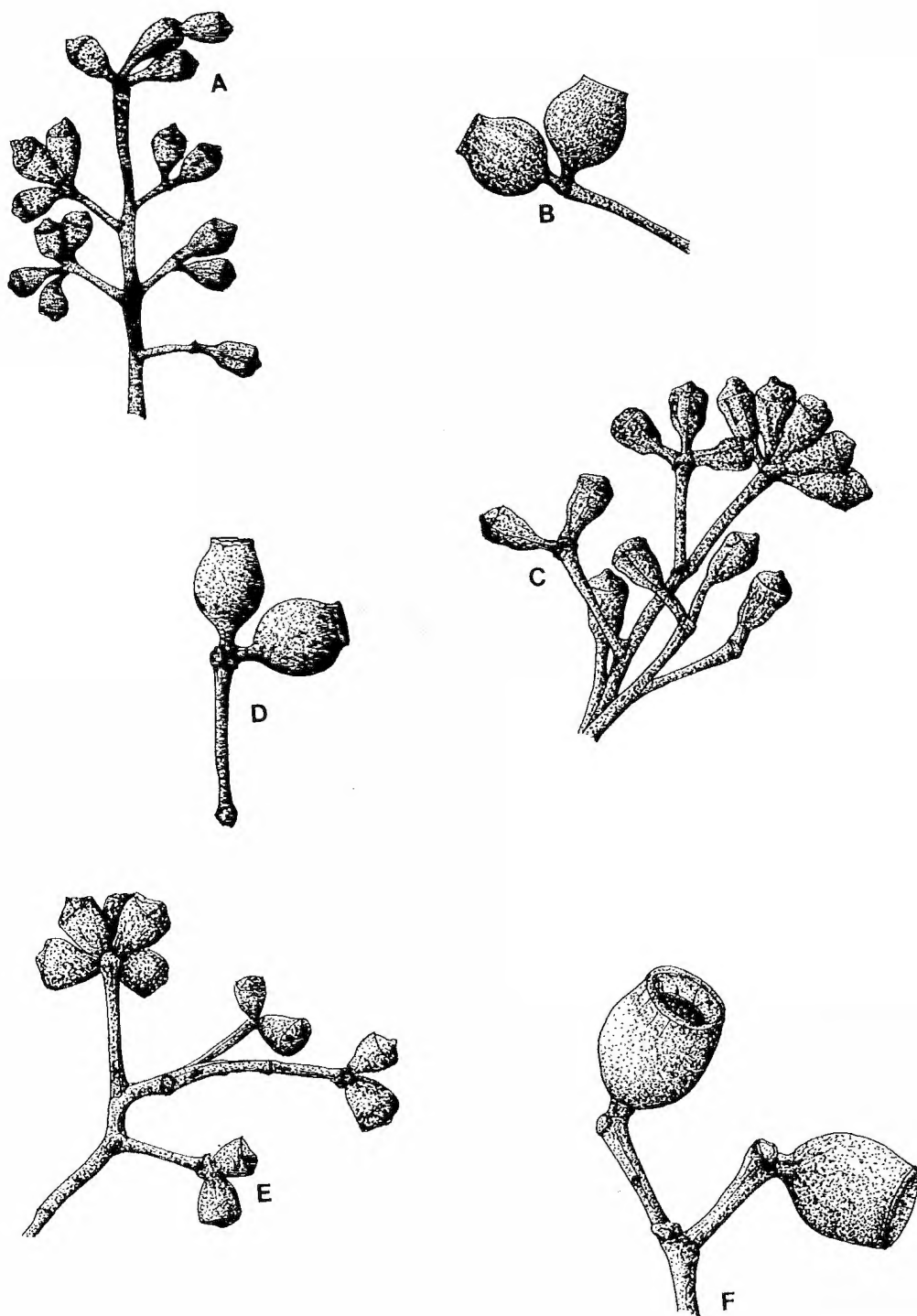


Fig. 10. *E. petalophylla*: A. buds $\times 1$. B. fruit $\times 1$. *E. bloxsomei*: C. buds $\times 1$. D. fruit $\times 1$. *E. aureola*: E. buds $\times 1$. F. fruit $\times 1$. A, Brooker 9765; B, Brooker 9763; C,D, Brooker 9791; E, Bean 502; F, Brooker 5330.

Distribution and habitat: This species has a restricted distribution in central Queensland, on the Cherwell Range, south of Moranbah and the Carborough Range, west of Nebo (Map 3). It grows on sandstone ridges on skeletal soils, and is associated commonly with *Acacia shirleyi* Maiden, *E. trachyphloia* F. Muell. and *E. papuana* F. Muell.

Flowering period: Unknown.

Etymology: From the Latin *aureolus*, golden, in reference to the bark.

Notes: *E. aureola* is most notable for the juvenile leaves which are long, narrow, peltate and glossy and resemble no other species in the series. The bark is strikingly golden-yellow.

12. *Eucalyptus leptoloma* Brooker & A. Bean, **sp. nov.** *Eucalypto bloxsomei* Maiden affinis a qua foliis plantularum valde peltatis, latis, nitentissimis, foliis adultis nitentibus valde discoloribus, alabastris brevioribus glaucis et fructibus brevioribus differt. **Typus:** Queensland. NORTH KENNEDY DISTRICT: c. 12 km W of Paluma, Queensland, 19 May 1989, *M.I.H. Brooker* 10207* (holo: BRI; iso: CANB, DNA, MEL, NSW).

Tree to 18 m tall, with erect trunk. Bark yellow or brownish yellow, persistent right to twigs. Seedling leaves remaining opposite for four or five pairs, third, fourth and fifth pair cordate and deeply dissected at base to point of petiole attachment, sixth and seventh pair slightly peltate. Stems, petioles and leaves hairy to about 6th pair, then glabrous apart from underside of midrib. Juvenile leaves alternate, peltate, broadly lanceolate, to 20 × 12 cm, glossy green, discolorous. Adult leaves lanceolate, to 14 × 4.1 cm, markedly discolorous with margins rolled under, dark glossy green on upper surface. Petioles 15–22 mm long, flattened. Peduncles up to 15 mm long. Unit inflorescences 7-flowered. Pedicels 1–3 mm long. Buds clavate, glaucous, 6–7 × 4.5–6 mm. Operculum conical. Fruits truncate-spherical, 8–9.5 × 8–9 mm. **Figs 11 & 12.**

Specimens examined. Queensland. NORTH KENNEDY DISTRICT: Towards Hidden Valley, 13.9 km W of Paluma, Jun 1989, *Bean* 1059* (BRI); 14 km W of Paluma, Mar 1990, *Brooker* 10407*, 10408*, 10409* (BRI, CANB, MEL, NSW); 8 km E of Hidden Valley on Paluma road, Aug 1984, *Hill* 1158 (NSW).

Distribution and habitat: *E. leptoloma* is a rare species known only from the Paluma-Hidden Valley road (Map 3), where it occurs near watercourses along a 2 km band. The riverine soil is white and coarsely sandy but on adjacent slopes, the species grows in shallow, sandy soil between outcropping granite. It is associated with *Syncarpia glomulifera* (Smith) Niedenzu, *E. resinifera* Smith, *E. acmenoides* Schauer, and *Casuarina torulosa* Aiton.

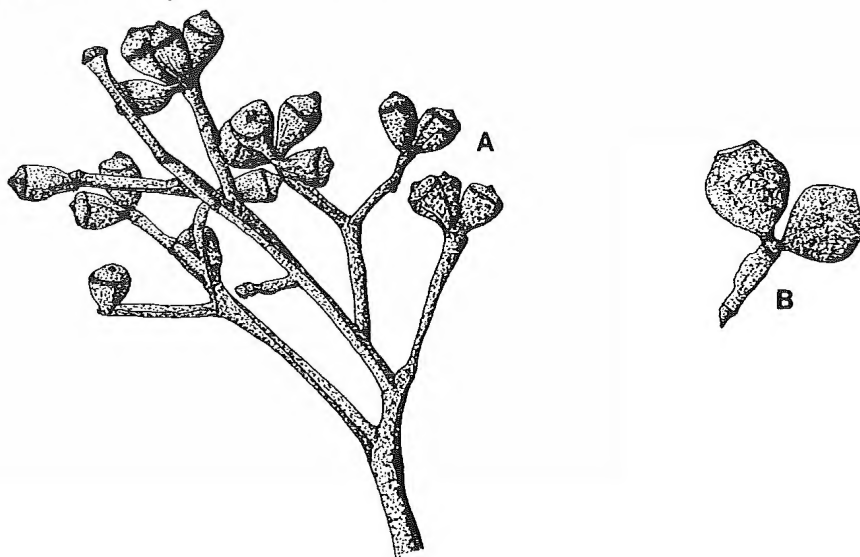


Fig. 11. *E. leptoloma*: A. buds × 1. B. fruit × 1. A, B, Brooker 10207.

Flowering period: Unknown.

Etymology: From the Greek *lepto*, narrow and *loma*, border, in reference to the slightly downturned edges of the adult leaves.

Notes: *E. leptoloma* has the tallest trees of any species in the series (possibly equalled by those of *E. bunites* and *E. bloxsomei*). It is unique in the series with its discolorous adult leaves that exhibit the minutely down-turned edges characteristic of other eucalypt species with discolorous leaves. The deeply cordate seedling leaves and subsequent broad, glossy, juvenile leaves are also distinctive. It is the only yellow bloodwood with rough bark to the twigs.

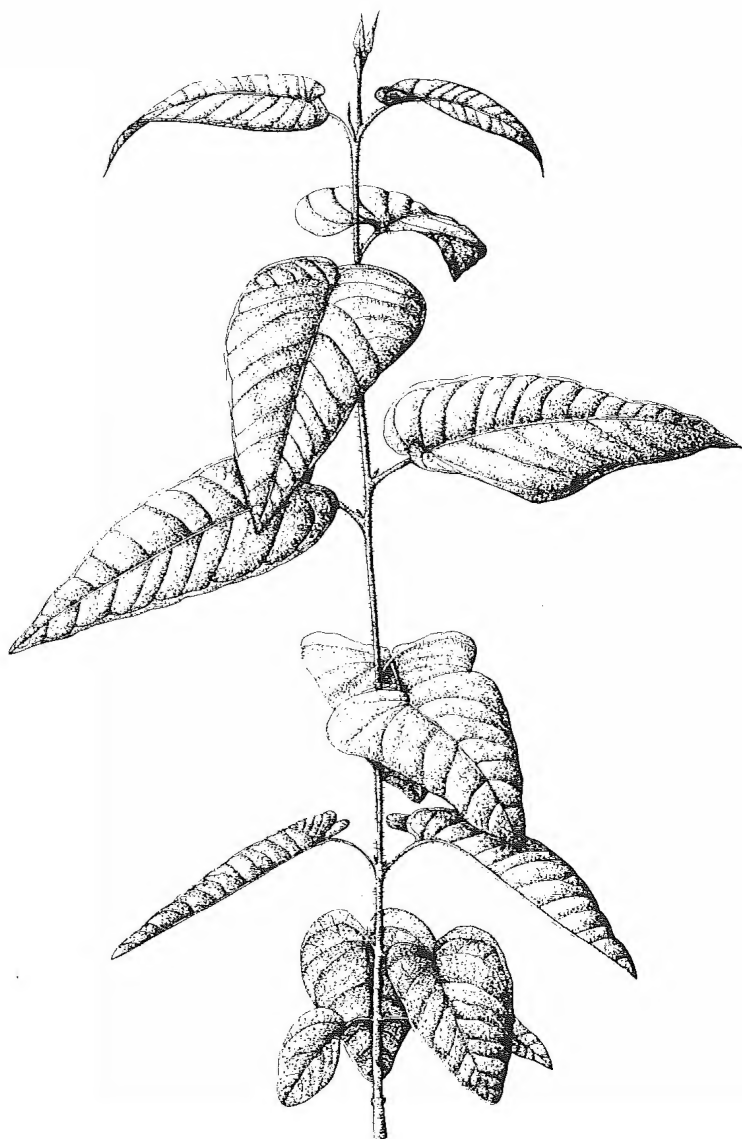


Fig. 12. *E. leptoloma*: from seedling of Brooker 10207 $\times 0.4$.

8. Phytogeography and species concepts

Because of its proximity to long-settled and highly populated areas of the central coast of New South Wales, the distribution of *E. eximia* is better known than that of the other yellow bloodwoods. Of more biological significance is its isolation by more than 600 km from its nearest congener, *E. bloxsomei*. Despite this disjunction, there appears to be no exceptional morphological divergence which would isolate it within the series. This may reflect the resistance to genetic modification from potential introgressing species such as other bloodwoods (*E. gummifera*, *E. maculata*), the stability of the environment or relatively recent disjunction.

The remainder of the species, all endemic in Queensland, occur often fragmented within their own distributional range over a north-south distance of about 1200 km and east-west distance of about 350 km. Because of the relative inaccessibility of much of this area, we have been unable to ascertain distributions of any taxon with accuracy comparable to that of *E. eximia*.

Broad-scale depictions of distribution as given in the conventional maps may conceal true biological disjunctions across which gene exchange is prevented. Nevertheless, we are satisfied with the morphological integrity of all the taxa we have treated and are not aware of any interspecific hybrids within series *Naviculares* despite sympatry in some areas. Intraspecific variation occurs, although coherence in the diagnostic characters at the species level is strong.

The least variable species in the series are *E. bloxsomei* and *E. scabrida*. This may reflect their relatively compact distributions across which gene exchange is active. *E. watsoniana*, which is partly sympatric with *E. bloxsomei*, is of much greater and probably sparser distribution than these species. The northern and southern forms of this species are clearly divergent in the juvenile phase while convergent in the adult. We recognise this phenomenon in the erection of subspecies.

E. bunites is another species with recognizably different juvenile forms at the ends of its known geographical range, but we consider the leaf colour distinction to be minor compared with the extremes of peltation and pubescence seen within *E. watsoniana*. Because of the wide distribution of *E. watsoniana* and the often inaccessible terrain where *E. bunites* occurs, we are unable to collect comprehensively along a transect to test further the patterns of morphological variation in relation to distribution for these two species. Perhaps further exploration will show *E. bunites* to be truly disjunct in its distribution.

It is likely that *E. bunites* is the most modified of the yellow bloodwoods because of its narrow juvenile leaves, the complete loss of peltation, the smallness of the buds and fruit and the extremely rare condition of reduced ovule row number. The species occurs towards the middle of the range of the Queensland yellow bloodwoods and is possibly sympatric with *E. watsoniana* subsp. *capillata*. In its Blackdown Tableland occurrence, *E. bunites* attains with *E. leptoloma* the highest altitude of occurrence recorded for species in series *Naviculares* (c. 900 m).

While distributions are imperfectly known, we are satisfied that *E. aureola*, through its apparent geographic isolation, is allopatric to all other yellow bloodwoods. This may be the case with *E. peltata* subsp. *dimorpha*, although it occurs close to *E. leichhardtii* and *E. peltata* subsp. *peltata* west of Townsville. *E. leptoloma* occurs within the distribution of *E. leichhardtii* in this area. The two species appear to be parapatric with the taller, green-leaved *E. leptoloma* occurring to the east of the smaller, slightly bluish-leaved *E. leichhardtii* and separated by less than 1 km.

At the eastern part of its very limited distribution, *E. leptoloma* occurs close to a tall stand of *E. grandis* west of the town of Paluma, north Queensland, which has an annual rainfall of 2685 mm. *E. leptoloma* is the only yellow bloodwood with discoloured adult leaves, a characteristic of *E. grandis* (series *Transversae* Blakely) and many other eucalypts of high rainfall areas. The other yellow bloodwoods have concolorous adult leaves and occur in drier sites.

The clearest intra-species disjunctions are in *E. petalophylla*, which is known from only two small occurrences, viz west of Eidsvold and south of Mundubbera, approximately 60 km apart, and in *E. leichhardtii*, which is the most widespread yellow bloodwood,

occurring from north-west of Mareeba, north Queensland, south to the Salvator Rosa National Park, central Queensland, while appearing to be completely absent from the lower parts of the Burdekin River catchment.

The most striking morphological feature in both the red and the yellow bloodwoods, and exclusive to them, is peltation of the seedling and juvenile leaves. This character has obviously been retained in both groups following their initial divergence. In the yellow bloodwoods peltation occurs in all but two taxa, *E. bunites* and *E. watsoniana*.

Two taxa, *E. peltata* subsp. *peltata* and *E. scabrida* are neotenuous while *E. peltata* subsp. *dimorpha* shows some ontogenetic development such that a reproductively mature tree has a crown of mixed juvenile, intermediate and adult leaves. These three taxa are in complete geographic isolation from each other and may have evolved as vicariants from relatively uniform ancestral juvenile stock. In all other species, healthy crowns are composed of adult leaves.

Throughout the genus *Eucalyptus* there are numerous examples of related species which differ, among other characters in the reproductively mature plant, by the juvenile/adult crown phenomenon. The juvenile crown in the mature plant may be a case of arrested ontogeny of no adaptive significance.

An alternative possibility is that the juvenile crown was secondarily imposed as a means of survival during prolonged aridity which caused the inevitable loss of or prevented the ultimate development of adult leaves. Any plants in such a stressed population that were reproductively mature in the juvenile phase were likely to have been strongly selected for.

We have not observed interspecific hybrids in the yellow bloodwoods, but hybrid combinations in areas of sympatry may be expected. In possible cases, e.g. *E. bloxsomei* × *E. watsoniana* subsp. *watsoniana* and *E. petalophylla* × *E. watsoniana* subsp. *watsoniana* (north-western occurrence), individual hybrid trees may be difficult to detect by superficial observation. Seedling comparisons would be of little use between these species pairs, as *E. petalophylla* and *E. watsoniana* subsp. *watsoniana* have somewhat similar seedlings and intermediates between *E. watsoniana*, a taxon with few or no peltate seedlings leaves, and *E. bloxsomei* with few, would provide a very fine distinction. The species of these pairs are distinguished largely by adult characters and hybrids may only be detectable by morphometric analyses. Recognition of hybridism between closely related and, by implication, morphologically similar species is always difficult.

In contrast, hybridism between highly dissimilar species is relatively easy to recognize. This occurs in the bloodwoods between Springsure and Rolleston where *E. citriodora* and *E. watsoniana* subsp. *capillata* grow together and hybridize (Brooker 4830, CANB). The cross between the smooth-barked and the rough-barked species produces individuals that are 1/2 rough-barked. Of more significance is the fact that *E. citriodora* carries the most distinctive genetic marker of all eucalypts. This is the presence of the lemon-smelling citronellal in the essential oils, which occurs in detectable (by crushing the leaves and smelling) quantities only in this species. The leaves of the hybrid also contain easily detectable citronellal. This is a rare example of an interseries cross in the bloodwoods, only reported once before for a cross between *E. gummifera* and *E. maculata* (Griffin *et al.* 1988).

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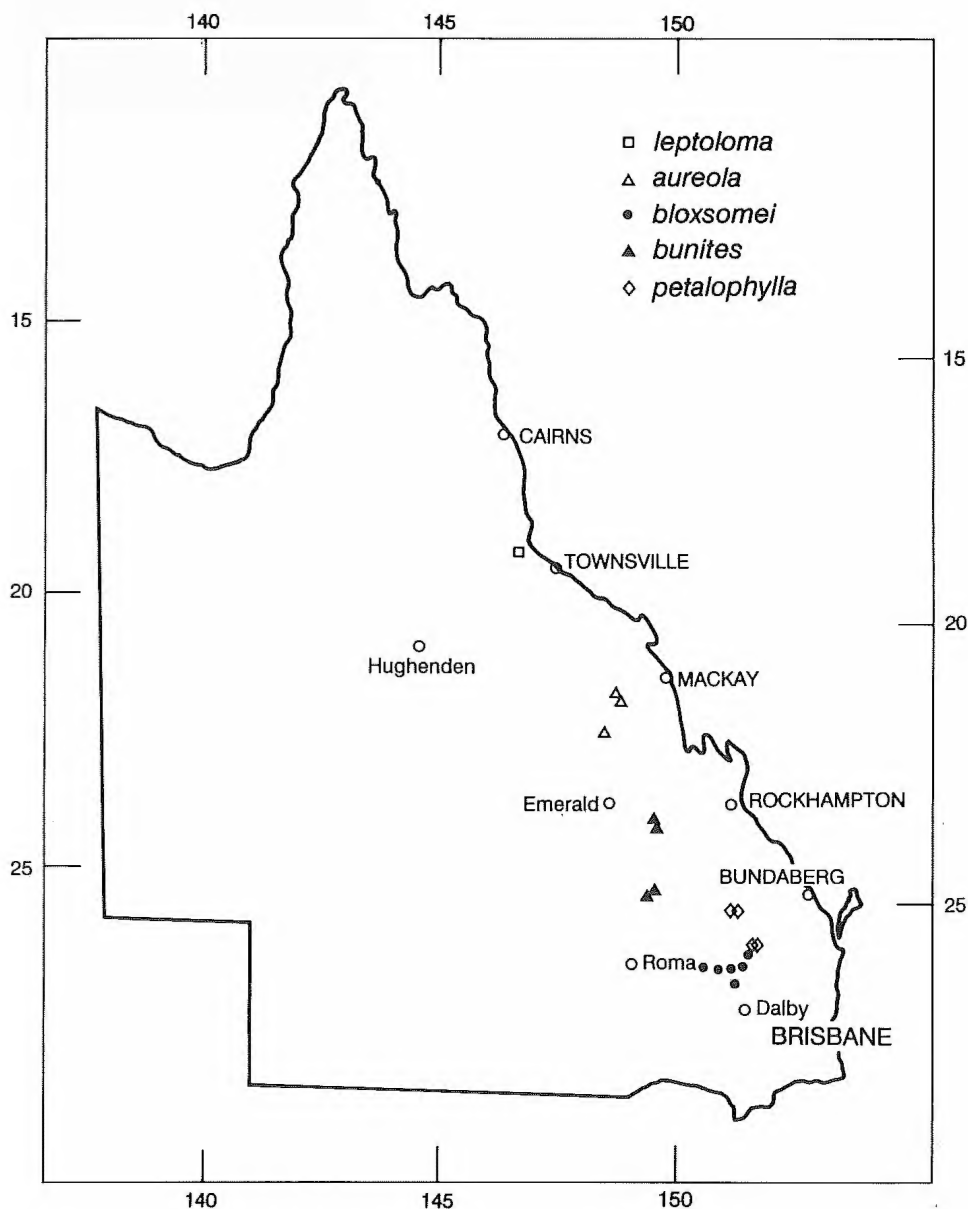
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THE GENUS *KOHAUTIA* CHAM. ET SCHLECHT. (RUBIACEAE) IN AUSTRALIA

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Summary

The first authentic record of the genus *Kohautia* Cham. et Schlecht. in Australia is made, with *K. australiensis*, the only Australian representative, described as new. Notes on distribution, habitat and conservation status of this species are given.

Introduction

The genus *Kohautia* Cham. et Schlecht. has approximately 60 species occurring throughout the old world tropics (Mabberley, 1989). Differing opinions on the distinctiveness of *Kohautia* have had it included in *Oldenlandia* in the sense of Hooker (1882) or *Hedyotis* in the sense of Wight and Arnott (1834). The revision of the African species of *Oldenlandia* L. by Bremekamp (1952) revealed that *Kohautia* can be distinguished from *Oldenlandia* by its monomorphic short-styled flowers. The corolla is hypocrateriform with the style and stigmata inserted in the lower part of the tube below the anthers which are included in the wider upper part of the corolla tube. The pollen grains of the genus also differ in structure and size from those of *Oldenlandia* and allied African genera. Lewis (1965) carried out an extensive cytopalynological study of the African Hedyotideae and concluded that *Kohautia* was distinct and should not be included in *Oldenlandia* or *Hedyotis*.

The genus has been recorded previously in Australia by Verdcourt (1976), but this appears to be an error which arose from misreading Bremekamp's (1952) distributional information (pers. comm. Dr. B. Verdcourt via Australian Botanical Liaison Officer (Dr. T. Macfarlane)). In the course of investigations into the Australian Hedyotideae for the Flora of Australia it became apparent that the taxon here described was quite distinct from the other Australian Hedyotideae and belonged in *Kohautia*.

All measurements have been taken from dried or reconstituted material.

Taxonomy

***Kohautia* Cham. et Schlecht., Linnaea 4: 156 (1829). Type: *Kohautia senegalensis* Cham. et Schlecht.**

Annual or perennial erect herbs rarely subshrubs. Leaves sessile, opposite or whorled. Stipules interpetiolar, adnate at the leaf-base, forming short sheath produced into single lobe or with 1–several fimbriae. Inflorescences of terminal or rarely axillary, lax, paniculiform or corymbiform cymes. Flowers 4-merous (rarely 5-merous), never heterostylous. Calyx lobes small, subulate to ovate-triangular or triangular, persistent. Corolla hypocrateriform; tube narrowly cylindrical, distinctly wider distally, throat glabrous or pilose; lobes valvate. Stamens entirely included in the upper widened part of corolla tube or rarely the anther-tips exserted. Style always included; stigma undivided, cylindrical or bifid; lobes filiform, erect; stigmata usually well below base of anthers or reaching the lower part of anthers. Ovary 2-locular; ovules numerous, immersed in fleshy placenta; placenta obloid attached peltately by short stalk to centre of septum. Capsule crustaceous, globose, ellipsoid or obloid, sometimes furrowed along dissepiment, beaked but not prominently so, loculicidally splitting between persistent calyx lobes. Seeds numerous, mostly not becoming viscid when moistened.

Distribution: The genus is distributed throughout Africa, India and Australia.

***Kohautia australiensis* Halford sp. nov.** quoad inflorescentias capsulasque *K. coccineae* Royle proxima, autem facile distinguenda corolla pallide caerulea, corollae tubo lobisque brevioribus (illo 2.5–4.5 mm longo vice 4.0–5.7 mm longo, his 0.5–1.0 mm longis vice 1.5–3.8 mm longis) calycis lobis triangularibus brevioribus (0.5–1.0 mm longis vice 1.8–5.2 mm longis). **Typus:** Western Australia. MUELLER

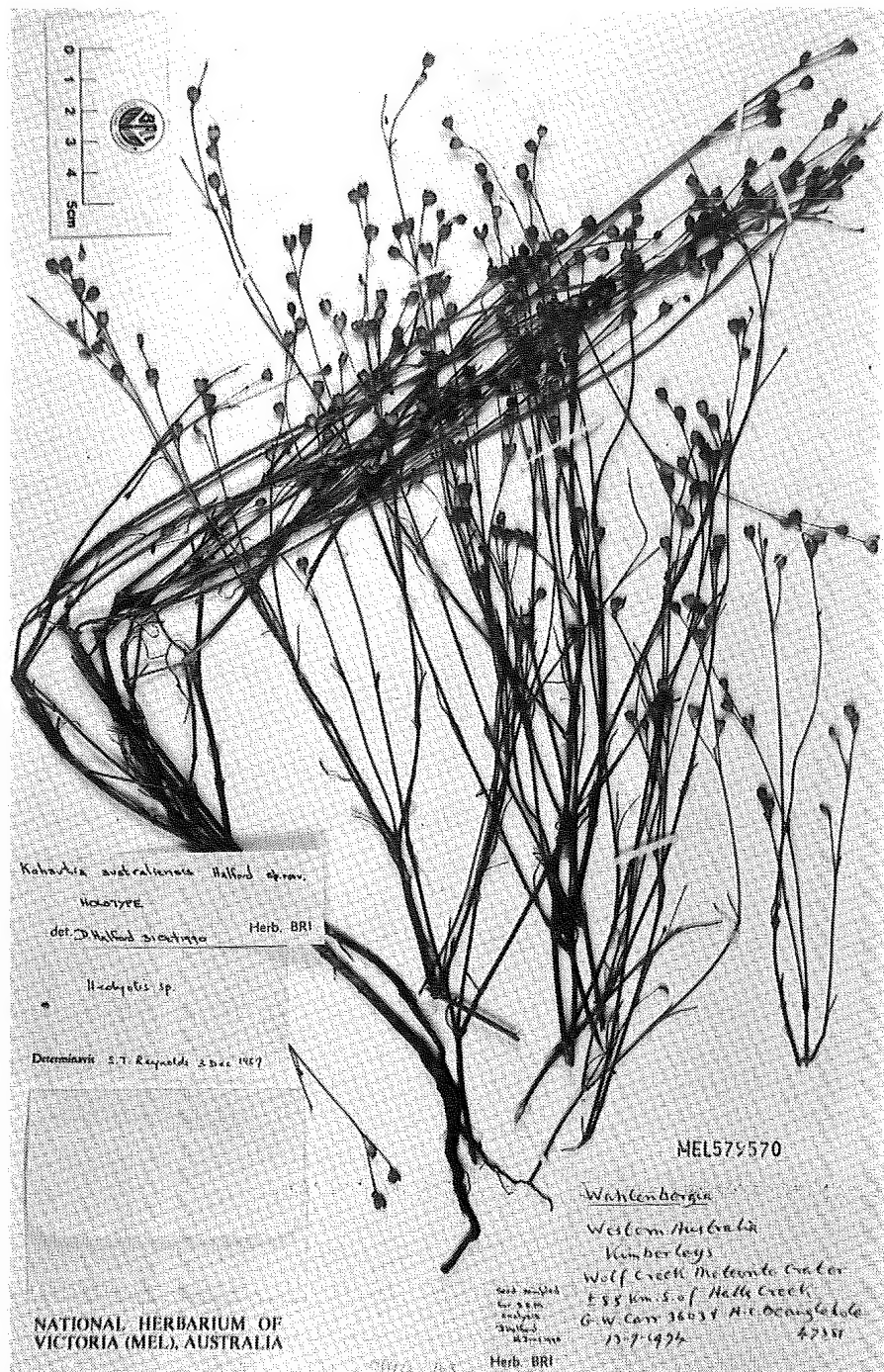


Fig. 1. Holotype of *Kohautia australiensis* Halford (Carr 3603 & Beauglehole 47381) at MEL.

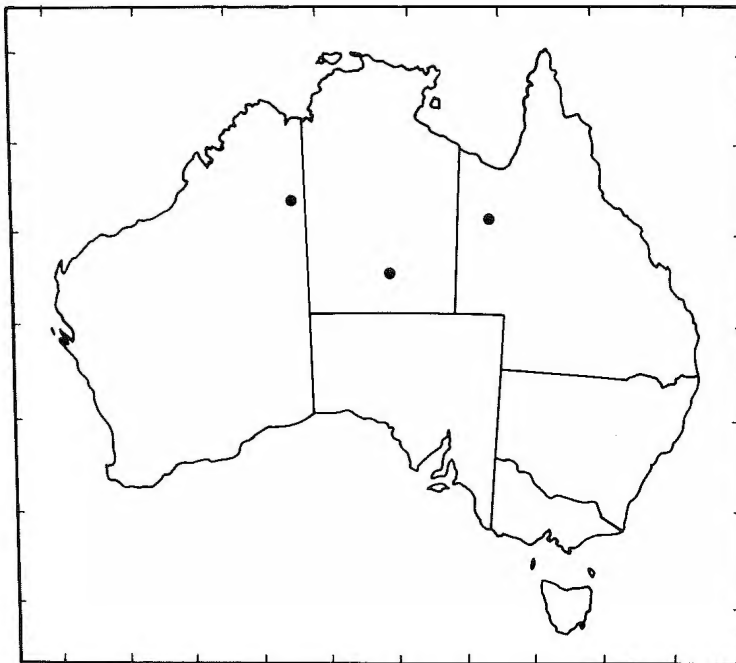
DISTRICT: Wolf Creek Meteorite Crater, July 1974, Carr 3603 & Beauglehole 47381 (holo: MEL).

Erect sparsely or much-branched annual herb 10–50 cm tall. Branchlets terete, papillose towards base. Leaves sessile, linear, 15–40 mm long, 0.5–1 mm wide, glabrous; margin recurved or revolute; midvein prominent below. Stipule-sheath 1–1.5 mm long, produced into a single lobe sometimes bifid at apex, 1–2 mm long; margin sometimes fimbriate. Inflorescence a lax, terminal cyme, monochasially branched or sometimes dichasially at the base. Flowers solitary, or paired at nodes on pedicels of unequal length; pedicels 0.5–1.5 mm long. Calyx lobes triangular, 0.6–1 mm long, glabrous; margin entire; collectors present in sinus between lobes. Corolla pale blue, hypocrateriform; tube 2.5–4.5 mm long, glabrous inside; lobes linear, 1–1.5 mm long, spreading, acute at apex. Anthers linear-oblong, 0.8–1 mm long, subsessile, basifixed or nearly so. Ovary ellipsoid, 1–1.3 mm long, papillate. Style slender 1.5–2.6 mm long; stigma bifid; lobes filiform, erect, 0.7–1.2 mm long, reaching base of anthers. Ovules c. 40 per locule. Capsule crustaceous, obloid-subglobose, 3.5–5 mm long, 3–4 mm wide, glabrous or sparsely papillate, slightly compressed, furrowed along dissepiment with persistent calyx lobes distant; beak 0.5–1 mm long, truncate. Seeds angular, obconic, numerous, c. 0.6 mm long; testa light brown.

Additional specimens examined: Northern Territory. CENTRAL SOUTHERN REGION: Ellery Gorge National Park, 23°47'S, 133°04'E, May 1984, Latz 9876 (AD,DNA). Queensland. BURKE DISTRICT: 14 km SSE of Mt Isa, 20°50'S, 139°37'E, Jun 1983, Schmid 636 (BRI).

Distribution and habitat: This species is known from only three disjunct localities in Western Australia (19°10'S, 127°48'E), Northern Territory (23°47'S, 133°04'E) and Queensland (20°50'S, 139°37'E) (Map 1). It has been noted growing on 'alluvial soils near creek' (Schmid 636) and on 'gravelly soil with *Triodia* on limestone foothill' (Latz 9876). The Northern Territory material was collected in an area of regrowth after fire (pers. comm. P.K. Latz).

Relationships: *K. australiensis* resembles *K. coccinea* Royle in inflorescence and capsule shape but can be distinguished from that species by having a pale blue corolla, shorter corolla tube (2.5–4.5 mm long compared to 4.0–5.7 mm long) and lobes (1.0–1.5 mm long compared to 1.5–3.8 mm long), and shorter, triangular calyx lobes (0.5–1.0 mm long compared to 1.8–5.2 mm long).



Map 1. Distribution of *Kohautia australiensis*.

Conservation status: Two of the three populations are within conservation reserves. A conservation coding of 3RC is appropriate based on criteria of Briggs and Leigh (1988).

Etymology: The specific epithet refers to Australia as this is the first authentic record of this genus from the continent.

Acknowledgements

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A TAXONOMIC REVISION OF *CYNANCHUM* L. (ASCLEPIADACEAE: ASCLEPIADOIDEAE) IN AUSTRALIA

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Summary

A taxonomic revision of the genus *Cynanchum* L. in Australia is provided and 11 species are recognised. A key to distinguish them is provided. Lectotypes are selected for six names.

Introduction

The genus *Cynanchum* was first described by Linnaeus (1753), based on five species. It is therefore one of the few genera in the Asclepiadaceae to be recognised as distinct from *Asclepias* L. at that time. Robert Brown (1810b, 1811) maintained *Cynanchum* and defined the genus by default in transferring most of the species included by Linnaeus to various new genera. Brown (1810a) added a number of species to the genus including two from Australia, namely *C. pedunculatum* R. Br. and *C. floribundum* R. Br. *Cynanchum* is most closely allied to *Sarcostemma* R. Br., and the two genera traditionally have been distinguished by the former having an inner staminal corona of five distinct or basally connate, often conduplicate, but not vesicular segments and lacking an outer corona, whereas the latter has an inner staminal corona of five distinct vesicular segments and an outer laminate corona (Woodson 1941; Rosatti 1989). Many taxa of *Cynanchum* are also characterised by the distinctive pendulous pollinia that are elliptic in outline with rounded ends and attached to short, straight, often somewhat thickened caudicles. In comparison, taxa of *Sarcostemma* usually have pendulous pollinia that are obovate-elliptic, always much wider at the end furthest from the caudicle and attached to long, often curved caudicles.

A great many genera of Asclepiadaceae since described can now be considered as being congeneric with the pantropic *Cynanchum*. Many of the generic names, especially those applying to neotropical plants, were placed in synonymy with *Cynanchum* by Woodson (1941) and this has been supported by a number of more recent workers (Spellman 1975; Sundell 1981; Henrickson 1987; Rosatti 1989). A number of genera described from Madagascar were also placed in *Cynanchum* by Descoings (1961).

The last treatment of *Cynanchum* in Australia was by Bentham (1869) who recognised both *Cynanchum* and *Vincetoxicum*, with four species in each genus. In New Guinea, Warburg (1891) described *Vincetoxicum discolor* and Schlechter (1914) mentioned the provisional name *Cynanchum neopommeranicum*. A number of authors have included *C. carnosum* (R. Br.) Schltr. as *Ischnostemma carnosum* or under other names (Forster 1988). Kuntze (1891) chose to place various Australian species belonging to *Tylophora* in the genus *Vincetoxicum*, but his account is confused and based on erroneous generic concepts. Domin (1928) did not regard *Vincetoxicum* as distinct from *Cynanchum* and made new combinations under the latter for most of the taxa described as new in the former by Bentham (1869). More recently, several apparently restricted taxa of *Cynanchum* have been described by Forster (1989) and Forster and Thongpukdee (1988).

Vincetoxicum Wolf has been often recognised as distinct from *Cynanchum*. The most recent proponents of *Vincetoxicum* as a distinct genus are Ali and Khartoon (1982) and Ali (1983). However, their arguments for recognising the genus as distinct are based on relatively trivial differences of the staminal corona. At most, *Vincetoxicum* should be accorded sectional status in *Cynanchum* (as section *Vincetoxicum* (Wolf) Tsiang & Li) (Tsiang & Li 1974), but until a monograph of the genus is undertaken, any infrageneric classification proposed would be premature in its taxonomic arrangements. As noted by Sundell (1981), any infrageneric classification will need to account for the precise placement of the lectotype of *Cynanchum*, *C. acutum* L., before the various infrageneric groups can be accorded their correct taxonomic status.

The name *Vincetoxicum* has been attributed to several authors (e.g. in Bentham (1869) it is given as Moench.). However, Bullock (1958) first incorrectly and then (1967) correctly indicated both the correct author and the earliest date of publication.

My brief has been to revise the genus as it occurs in Australia as a precursor to a 'Flora of Australia' treatment, and this paper concentrates primarily on a taxonomic account of the species from this region. Hence, it has not been possible, given the time and resources available, to adequately deal with the many problems concerning both the generic and infrageneric classification of *Cynanchum* s. lat. worldwide. Therefore, I have chosen to recognise a broadly defined *Cynanchum*, thus taking into account a diverse assemblage of vines, herbs and succulent shrubs (cf. Descoings 1961; Spellman 1975; Sundell 1981; Rosatti 1989). Considerable floral variation is present in these taxa with respect to the shape and degree of lobing of the staminal corona. This floral variation may be viewed as representing various degrees of specialization with respect to different pollinators. However, at this stage there is no available information on the pollinators of species of *Cynanchum* in Australia, or elsewhere for that matter.

Despite the lack of a satisfactory world-wide infrageneric classification of *Cynanchum*, it is possible to allocate the Australian taxa into a number of groups. These groups can be defined on habit and floral characters, particularly the form of the staminal corona.

Group 1. Erect seasonally deciduous herbs; staminal corona of 5 simple lobes. *C. brachystelmoides*, *C. christineae* and *C. liebiana*.

Group 2. Evergreen lianes; staminal corona of 5 simple lobes. *C. bowmanii*, *C. carnosum*, *C. elegans* and *C. leptolepis*.

Group 3. Evergreen or seasonally deciduous lianes; staminal corona consisting of 5 connate lobes forming a tube around the base of the staminal column and usually divided into as many as 25 variously shaped lobes. *C. floribundum*, *C. ovalifolium*, *C. pedunculatum* and *C. puberulum*.

If a sectional classification is applied to these groups, then Groups 1 and 2 belong to the section *Vincetoxicum*, whereas Group 3 belongs to section *Cynoctum* (E. Meyer) Schumann. The section *Cynoctum* would appear equivalent to the subgenus *Mellichampia* (A. Gray ex S. Wats.) Woods. as defined by Sundell (1981).

Species of **Group 1** are closely allied to a number of taxa from Asia, particularly the Chinese *C. riparium* Tsiang & Zhang and *C. hydrophilum* Tsiang & Zhang. An unusual characteristic of this group is the ability of two species, namely *C. brachystelmoides* and *C. liebiana*, to tolerate seasonal flooding. Both these species have stems that are hollow, except for one or two internodes below the growing apex, one or two internodes above the rootstock, and the nodes themselves. This is a most unusual feature for an asclepiad and presumably parallels the hollow or air-ducted stems found in many strictly aquatic plants (Arber 1920; Sculthorpe 1967). These hollow or air-ducted stems with minimal xylem development represent adaptations to the problem of transporting air to the root systems that are often situated in low-oxygen or strictly anaerobic situations, while still maintaining transpirational flow (Zimmerman 1983).

Species of **Group 2** such as *C. bowmanii* and *C. elegans* are similar to a number of taxa from the Indian subcontinent (Hooker 1885; Ali & Khartoon 1982), but the endemic Australian taxa appear more closely related to one another than to any species from elsewhere. The distribution of *C. ovalifolium* from India to Australia is quite remarkable. However, this species is easily recognised, by the distinctive stipular outgrowths at the nodes.

The flowers of species of **Group 3** are superficially similar to a number of succulent-stemmed taxa from Madagascar such as *C. macrolobum* Jum. & Perr. and *C. mahafalense* Jum. & Perr. (Descoings 1961) and to a number of the species discussed by Sundell (1981). However, the Australian taxa are radically different in vegetative form from these species, and, with the exception of the somewhat shrubby *C. floribundum*, are all seasonally renascent. Without comparative studies of other leafy taxa of the genus from Asia, I am reluctant to suggest relationships, although *C. pedunculatum* and *C. puberulum* appear to be closely allied to each other.

Materials and Methods

Floral descriptions are based on spirit or reconstituted dried material. Foliage and fruit descriptions are based on herbarium material. Indumentum cover is described as defined by Hewson (1988), except that the term 'scattered' is used instead of 'isolated'. Herbarium holdings at AD, BRI, CANB, CBG, DNA, JCT, MEL, NE, PERTH and QRS, partial holdings at A, L and NSW and photographs or microfiche of relevant type material at BM, K, G and P were examined. Material was collected or procured in Australia between 1981 and 1990. In selecting specimens to cite, preference has been given to fertile, widely duplicated collections or those that indicate the geographic range of the taxon concerned. Generic synonymy is restricted to those names applicable to Australian taxa. More comprehensive generic synonymies may be found in Woodson (1941), Descoings (1961), Sundell (1981) and Rosatti (1989).

Taxonomic Treatment

Cynanchum L., Sp. Pl. 212 (1753). **Type:** *Cynanchum acutum* L.

L., Gen. Pl. ed. 5, 101 (1754); R. Br., Prodr. 462–463 (1810); Mem. Wern. Nat. Hist. Soc. 1: 43–48 (1811); Wight, Contrib. bot. India 55–59 (1834); G. Don., Gen. Syst. 4: 150 (1837); Decne. in DC., Prodr. 8: 547–552 (1844); Benth., Fl. austral. 4: 331–333 (1869); Benth. in Benth. & J.D. Hook., Gen. Pl. 2: 762–763 (1876); J.D. Hook., Fl. Brit. India 4: 21–26 (1885); Schumann in Engl. & Prantl., Nat. Pflanzenfam. 4(2): 250–253 (1897); Bailey, Queensl. fl. 3: 1001–1002 (1900); Schltr., Bot. Jahrb. Syst. 50: 93 (1914); Tsiang, Sunyatsenia 4: 107–119 (1939); Woodson, Ann. Missouri Bot. Gard. 28: 208–216 (1941); Bakhuizen van den Brink, Blumea 6: 369–370 (1950); Descoings, Adansonia 1: 299–342 (1961); Backer & Bakhuizen van den Brink, Fl. Java 3: 252–253 (1965); Stearn, Phytologia 21: 137–138 (1971); Markgraf in Tutin *et al.*, Fl. Europ. 3: 71 (1972); Tsiang & Li, Acta Phytotaxon. Sin. 12: 83–112 (1974); Spellman, Ann. Missouri Bot. Gard. 62: 115–122 (1975); Hausner, Beitr. Biol. Pflanz. 52: 101–126 (1976); Sundell, Evol. Monog. 5: 1–63 (1981); Ali, Fl. Pakistan 150: 9–17 (1983); Huber, Rev. Fl. Ceylon 4: 79–81 (1983); Konta *et al.*, Acta Phytotax. Geobot. 37: 59–68 (1986); Henrikson, Sida 12: 91–99 (1987); Forster, Austrobaileya 3: 110–114 (1989).

Derivation of Name: Greek, *kynos*, dog, and *ancho* to strangle, alluding to the supposed use of some European species for poisoning dogs or other vermin.

Vincetoxicum Wolf, Gen. Pl. 130 (1776). **Type:** *V. hirundinaria* Medikus [= *Asclepias vincetoxicum* L.]

Wolf, Gen. Sp. 269 (1781); Medikus, Hist. Commentat. Acad. Elect. Sci. Theod.-Palat. 6: 404 (1790); Moench., Method. 717 (1794); Endl., Gen. 591 (1838); Decne. in DC, Prodr. 8: 523–526 (1844); Benth., Fl. austral. 4: 330–331 (1869); Benth. in Benth. & J.D. Hook., Gen. pl. 2: 761–762 (1876); Bailey, Queensl. fl. 3: 999–1001 (1900); Bullock, Kew Bull. 13: 302 (1958); Kew Bull. 21: 351 (1967); Rechinger f., Fl. Iran 73: 10 (1970); Markgraf, Bot. J. Linn. Soc. 64: 370–376 (1972); Markgraf in Tutin *et al.*, Fl. Europ. 3: 71 (1972); Vakili-Nejad, Rev. Gen. Bot. 84: 79–88 (1977); Ali & Khartoon, Pak. J. Bot. 14: 61–68 (1982); Ali, Fl. Pakistan 150: 31–38 (1983); non *Vincetoxicum* Walter, Fl. Carol. 13: 104 (1788).

Cynoctonum E. Mey., Comment. Africae 215 (1837). **Type:** not designated.

Endl., Gen. 591 (1831); Decne. in DC, Prodr. 8: 527–532 (1844); Miq., Fl. Ned. Ind. 2: 748 (1834). non J. F. Gmelin (1791).

Cyathella Decne., Ann. Sci. Nat. Bot. 2 ser. 9: 332, t. 12 (1838).

Substitute name for *Cynoctonum* E. Mey.

Herbs, subshrubs or vines, perennial, terrestrial or aquatic, with clear, white or yellow latex. Stems slender, woody or succulent, glabrous or with indumentum. Roots fibrous. Leaves opposite, flattened in cross-section, ovate, elliptic, linear, lanceolate, fleshy, coriaceous, herbaceous, sometimes scale-like; usually petiolate with small stipular structures at base; extrafloral nectaries present or absent at lamina base. Cymes appearing at nodes between the pair of leaves, sessile to pedunculate, umbelliform to racemiform, with 1–many fascicles. Sepals 5, distinct, generally with glands at base of lobes. Corolla deeply 5-lobed, rotate, campanulate or urceolate; lobes/petals valvate or variously imbricate. Staminal corona in the simplest form consisting of 5 lobes adnate to the base of

the staminal column, sometimes with extra lobing at or between the bases of these lobes; in the most complex form consisting of 5 connate lobes forming a tube around the base of the staminal column and usually divided into as many as 25 variously shaped lobes that may or may not overtop both the staminal column and the style-head. Stamens inserted at corolla-tube base, connate; anthers incurved, with incurved terminal appendages. Pollinaria each with 2 pollinia; pollinia smooth, pendulous, 2 in each anther cell, ellipsoid, ovoid or oblong, lacking pellucid margins; corpusculum oblong, tan to brown; caudicles flattened, often nearly as broad as long. Gynostegium flat-topped to umbonate with obtuse or capitate style-head; ovaries free or only the tip joined, glabrous. Follicles fusiform to ovoid, smooth or roughened; triangular to semi-terete in cross-section, single or more rarely paired. Seeds flat to boat-shaped, ovate, brown; comose with white hairs at micropylar end only, or lacking hairs.

Over 200 species worldwide. Eleven species in Australia.

Key to Australian species of *Cynanchum*

1. Plants twining 2
Plant generally erect, not twining 9
2. Extrafloral nectaries absent from base of leaf lamina.
NG,WA,NT,Q,NSW 1. *C. carnosum*
Extrafloral nectaries present at base of leaf lamina 3
3. Staminal corona of 5 separate lobes 4
Staminal corona comprising 5 outer lobes and 5 inner lobes, or appearing
tubular with various appendages 6
4. Leaves fleshy, ovate; corona lobes abruptly acuminate.
NSW 6. *C. elegans*
Leaves membranous, ovate, ovate-lanceolate or cordate-ovate; corona
lobes not abruptly acuminate 5
5. Leaves ovate, ovate-lanceolate or cordate-ovate; staminal corona lobes
± same length as staminal column Q 7. *C. bowmanii*
Leaves cordate-ovate; corona lobes more than twice as long as staminal
column. NT,Q 8. *C. leptolepis*
6. Leaves glabrous, membranous. NG,Q 9. *C. ovalifolium*
Leaves pubescent, rarely glabrous; coriaceous 7
7. Sepals c. 1 mm long, follicles 25–30 mm long. WA,NT,Q,NSW,
SA 3. *C. floribundum*
Sepals 2–3 mm long, follicles 60–80 mm long 8
8. Lobes of outer corona produced into long subulate points, foliage densely
pubescent. NT,WA 10. *C. puberulum*
Lobes of outer corona truncate, crenulate, shortly obtuse, denticulate or
acuminate; foliage glabrous to sparsely pubescent. WA,NT,
Q 11. *C. pedunculatum*
9. Staminal corona of 5 separate lobes 10
Staminal corona comprising 5 outer lobes and 5 inner lobes, or appearing
tubular with various appendages 11
10. Corolla purple; lobes lanceolate, 10–11 mm long. NT 2. *C. liebiana*
Corolla cream; lobes lanceolate to ovate, 1.5–4.5 mm long. NG,
NT,Q 3. *C. brachystelmoides*

11. Staminal corona appearing tubular with various appendages. WA, NT, Q,
NSW, SA 3. *C. floribundum*
Staminal corona comprising 5 outer lobes and 5 inner lobes.
NT 5. *C. christineae*

1. *Cynanchum carnosum* (R. Br.) Schltr. in Perkins, *Fragm. Flor. Philipp.* 120 (1904); *Oxystelma carnosum* R. Br., *Prodr.* 462 (1810); *Vincetoxicum carnosum* (R. Br.) Benth., *Fl. austral.* 4: 331 (1869); *Ischnostemma carnosum* (R. Br.) Merrill & Rolfe, *Phillip. J. Sci.* 3(3): 121 (1908); *Cynanchum carnosum* (R. Br.) Domin, *Biblioth. Bot.* 22 (89): 1085 (1928), *nom. superfl.* **Type:** Queensland. COOK DISTRICT: Island a [Sweer's Island, Gulf of Carpentaria], November 1802, *Brown* s.n. (lecto: BM, two sheets, *n.v.*, photo at BRI!).

Forster, *Austrobaileya* 2: 525–527 (1988); Wightman, *Mangroves of the Northern Territory* 57–59 (1989).

Ischnostemma selangorica King & Gamble, *J. Asiat. Soc. Bengal, Pt. 2 Nat. Hist.* 74: 532 (1907). **Type:** Selangor, at Kwala Selangor, *Ridley* 7564 (*n.v.*).

Pentatropis novoguineensis Val. ('*novo-guineensis*'), *Bull. Dep. Agric. Ind. Neerl.* 10: 49 (1907). **Type:** *Atasrip* 96 (*n.v.*).

van Steenis & Bakhuizen van den Brink, *Bot. Jahrb. Syst.* 86: 385–401 (1967).

Herbaceous vine, latex white. Stems cylindrical, up to 2 mm diameter, glabrous; internodes up to 9 cm long. Leaf petiolate; lamina fleshy, elliptic to obovate, up to 6.5 cm long and 2.5 cm wide, concolorous, grey-green to pale green; above glabrous, venation obscure; below glabrous, secondary veins 4–5 per side of midrib, glabrous; tip acuminate to apiculate; base cuneate to rounded; petiole grooved along top, up to 9 mm long and 2 mm wide, glabrous or with scattered indumentum; extrafloral nectaries absent from lamina base. Cymes umbelliform, up to 4 cm long, with 1–5 flowers; peduncle up to 3.2 cm long and c. 1 mm diameter, glabrous or with scattered indumentum; bracts lanceolate, 1.4–1.5 mm long, 0.75–0.9 mm wide, glabrous. Flowers subrotate, 2.5–5 mm long, 8–13 mm diameter; pedicels 7–17 mm long, 0.5–0.8 mm diameter, glabrous, light green with some brown splotches. Sepals lanceolate, 1.5–2.7 mm long, c. 1 mm wide, glabrous, light green, base of each sinus with 1 gland. Corolla greenish yellow to cream; tube 1.5–2 mm long, 2.5–3 mm diameter; lobes twisted to right in bud and at anthesis, lanceolate, 5–9 mm long, 1.8–2.5 mm wide, glabrous. Staminal corona comprising 5 free lobes, 2.3–3 mm long, c. 2 mm diameter, pale green to cream; each lobe oblong-rectangular at base and 0.8–1.25 mm wide, tapering to a subulate tip 0.1–0.3 mm wide. Staminal column 1.8–2.5 mm long, 1.25–1.8 mm wide; anther appendages triangular to lanceolate, 0.75–1 mm long, 0.4–0.8 mm wide; slit between anther wings 1–1.25 mm long. Style-head domed, not exceeding anther appendages, 0.6–0.9 mm long, 1–1.3 mm diameter, pale green. Ovaries c. 1.5 mm long, 0.75–1 mm wide. Pollinarium 0.5–0.57 mm long, 0.32–0.5 mm wide; pollinia oblong, 0.24–0.3 mm long, 0.11–0.13 mm wide; corpusculum oblong, 0.21–0.26 mm long, 0.09–0.14 mm wide; caudicles 0.11–0.15 mm long, 0.02–0.05 mm wide. Follicles fusiform, 7.3–7.5 cm long, 1.3–1.4 cm wide, glabrous. Seed ovate, 4–5 mm long, c. 3 mm wide; coma 15–20 mm long, white. **Fig. 1.**

For a discussion of the nomenclatural history of this species, a listing of selected specimens, and notes on phenology and conservation status, reference should be made to Forster (1988).

Distribution and habitat: *C. carnosum* is widespread in Australia (**Map 1**), New Guinea and parts of south-east Asia as a plant of the littoral zone where it usually grows just above the high-water mark often among rocks.

2. *Cynanchum liebiana* (F. Muell.) P. Forster, *Austrobaileya* 3: 110 (1989); *Tylophora liebiana* F. Muell., *J. Proc. Roy. Soc. New South Wales* 24: 78 (1891). **Type:** Northern Territory. Port Darwin, 1890, *M. Holtze* 1010 (holo: MEL!). **Fig. 4S–T.**

See Forster (1989) for a description and notes on distribution, habitat, phenology and conservation status.

Additional notes: R. Tingey, who was instrumental in the rediscovery of this plant, has shown photographs and drawings of it to a number of people. Some of these people claim to have seen this plant flowering in swamps in Arnhem Land and so it may be more widespread than the few herbarium specimens would indicate.

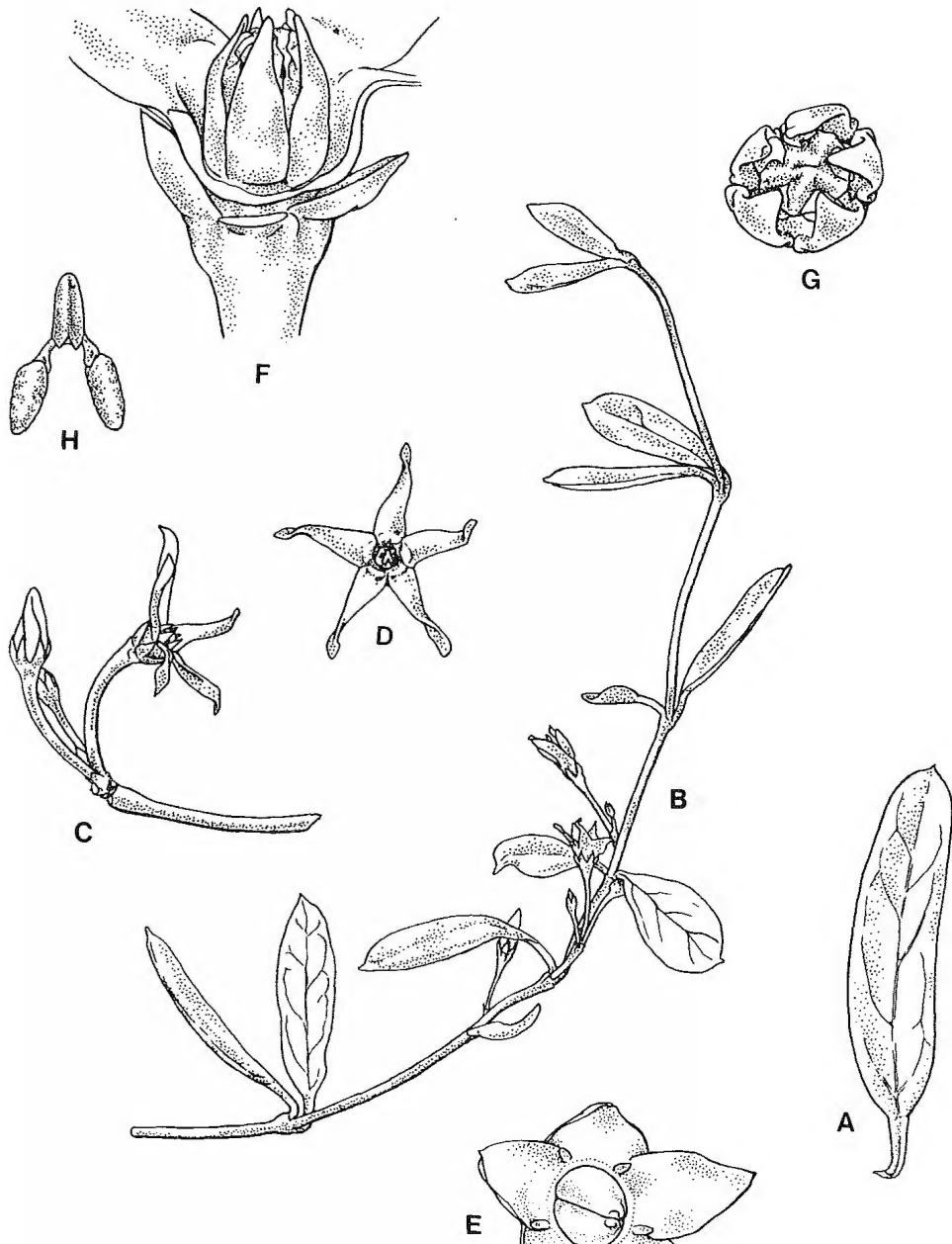


Fig. 1. *Cynanchum carnosum*: A. leaf $\times 1$. B. habit of flowering stem $\times 1$. C. inflorescence $\times 2$. D. face view of flower $\times 2$. E. face view of calyx and ovaries with corolla removed $\times 11$. F. side view of flower with corolla partly removed and showing staminal corona $\times 9$. G. face view of gynostegium $\times 9$. H. pollinarium $\times 40$. All from spirit material of Forster 3306. Del. K. Harold.

3. *Cynanchum floribundum* R. Br., Prodr. 463 (1810); *Cynoctonum floribundum* (R. Br.) Decne. in DC., Prodr. 8: 529 (1869); *Vincetoxicum floribundum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). **Type:** South Australia. Spencers Gulf [Bay 12, South Coast], 10 March 1802, R. Brown (lecto (here designated): BM, 2 sheets, n.v., photo at BRI!; isolecoto: CANB(CANB278884!)).
 Benth., Fl. austral. 4: 332 (1869); Bailey, Queensl. fl. 3: 1001 (1900); W. Fitzg., Proc. Roy. Soc. Western Austral. 3: 196 (1928); K.L. Wilson, Fl. Central Austral. 278 (1981).

Erect shrub to 1 m high or somewhat sprawling, latex white. Stems cylindrical, up to 5 mm diameter, woody at base; internodes up to 12 cm long. Leaves petiolate; lamina lanceolate to lanceolate-ovate, up to 11.5 cm long and 45 mm wide, concolorous; above green, venation obscure, with scattered indumentum; below green, secondary veins 6 per side of midrib, with scattered to sparse indumentum; tip acute to acuminate; base cuneate to truncate; petiole up to 25 mm long and 0.5 mm wide, with scattered to sparse indumentum; extrafloral nectaries 2 at lamina base. Cymes with 1–4 fascicles, up to 4 cm long; peduncle up to 6 cm long, and c. 1 mm diameter, glabrous; bracts linear-lanceolate, 1–1.5 mm long, 0.25–0.75 mm wide, with sparse indumentum. Flowers rotate, 2.5–7 mm long, 8–10 mm diameter; pedicels 5–15 mm long, c. 1 mm diameter, with sparse indumentum. Sepals triangular to lanceolate-ovate, 1.8–3 mm long, 1–2 mm wide, ciliate, bases of sinuses with 1–3 glands. Corolla yellow to cream; tube 0.9–1 mm long, 1.6–4 mm diameter; lobes lanceolate, reflexed, 3.9–8 mm long, 1.6–3 mm wide, glabrous. Staminal corona yellow to cream, 1.6–7 mm long, 2–7 mm diameter, tubular with 10–15 irregular lobes; tube 1.5–2 mm long, lobes 4–5.7 mm long. Staminal column 1.5–3.5 mm long, 1.4–2.5 mm wide; anther appendages lanceolate to ovate-crenulate, 0.8–2 mm long, 0.6–1 mm wide, exceeding style-head by 0.4–1 mm; slit between anther wings 0.7–1.25 mm long. Style-head conical, 0.6–1 mm long, 0.9–1.5 mm diameter. Ovaries c. 1.5 mm long and 1 mm wide. Pollinarium 0.35–0.6 mm long, 0.6–0.9 mm wide; pollinia ovoid-globose, 0.2–0.4 mm long, 0.14–0.22 mm wide; corpusculum 0.23–0.35 mm long, 0.14–0.2 mm wide; caudicles 0.08–0.15 mm long, 0.04–0.12 mm wide. Follicle fusiform-ovoid, 3–6.5 cm long, 5–25 mm wide. Seed oblong-ovate, 7–8 mm long, 4 mm wide; coma white, 15–28 mm long. **Fig. 2.**

Selected specimens: Western Australia. Enderby Is, 20°36'S, 116°29'E, Jul 1980, *Kenneally* 7263 (CANB,PERTH); 9 km W of Shay Gap, 20°29'S, 120°06'E, Jul 1984, *Newbey* 10272 (PERTH); Crossing of Caroline Creek on road to Millstream, c. 25 km SW of Pyramid HS, 21°14'S, 117°19'E, Aug 1977, *Barker* 2108 (AD,MEL). Rudall River N.P., 22°32'S, 122°24'E, Apr 1979, *Mitchell* 881 (DNA,PERTH); Vampire Gorge, Hammersley Range, Aug 1959, *Gardner* 12277 (PERTH); Mt Herbert, 59 miles [98 km] from Roebourne on Wittenoom Road, Mar 1962, *George* 3507 (PERTH). Northern Territory. Stirling Creek, 21°40'S, 133°47'E, Aug 1985, *Leach & Smith* 697 (CANB,DNA,NSW); Old Redbank HS, "Narwietooma", 23°29'S, 132°50'E, Oct 1979, *Nelson* 2473 (BRI,DNA); 13 miles [22 km] NW "Napperby", *Chippendale* [NT2062] (DNA,MEL); c. 70 miles [117 km] WNW of Mt Singleton, Jun 1957, *Chippendale* [NT3348] (BRI,CANB,DNA,MEL). Queensland. BURKE DISTRICT: Spring Creek, 17 km N of Mt Isa, 20°32'S, 139°29'E, Feb 1985, *Harris* 39 (BRI). GREGORY NORTH DISTRICT: 6 km NW of "Makunda Downs", 22°21'S, 141°16'E, Jun 1979, *Purdie* 1545 (BRI); 21 km N of Diamantina Lakes Stn turnoff, Springvale - Diamantina Road, 23°42'S, 141°01'E, May 1977, *Schmid* 314 (BRI). New South Wales. Wild Dog Fence, Muncardie & Orka Gates, Feb 1980, *Barlow* [NSW191104] (NSW). South Australia. On Strzelecki Track, c. 134 km S of Moomba Gasfield, 29°09'S, 140°05'E, May 1977, *Lazarides* 8383 (BRI,CANB); Yaningurie Waterhole, 28°58'S, 140°06'E, Jul 1982, *Olsen* 176 (BRI); Lyndhurst-Innaminka Road, at Merti-Merti turnoff, 28°50'S, 140°10'E, Sep 1986, *Ballingall* 2262 (AD,BRI); 4.8 km N of Hawkers Gate on the border fence, 29°45'S, 141°00'E, May 1977, *Chinnock* 3505 (AD,MEL); Vicinity of Paralana Springs, 30°11'S, 139°27'E, Aug 1968, *Symon* 6018 (AD,CANB).

Distribution and habitat: This species is widespread over arid central Australia (**Map 1**) and is commonly found on sand ridges in association with *Zygochloa paradoxa* and *Triodia* species.

Phenology: Flowering after rain throughout the year. Fruiting occurs 2–3 months later.

Conservation status: Not rare or endangered.

4. *Cynanchum brachystelmoides* P. Forster, Austrobaileya 2: 451 (1988). **Type:** Queensland. COOK DISTRICT: 5 km W of the Watson River crossing on the Aurukun - Merluna road, c. 40 km NE of Aurukun, Dec 1981, *J.R. Clarkson* 4053 (holo: BRI!; iso: CANB!,DNA!,QRS!).

Herbaceous, erect perennial, latex lacking. Roots fusiform to 40 mm long. Stems upright, up to 35 cm long, 0.5–4.0 mm thick, with 3–5 branches, up to 10 nodes; internodes up to 5 cm long. Leaves linear, lacking extrafloral nectaries at base, 5–20 mm long, 0.25–

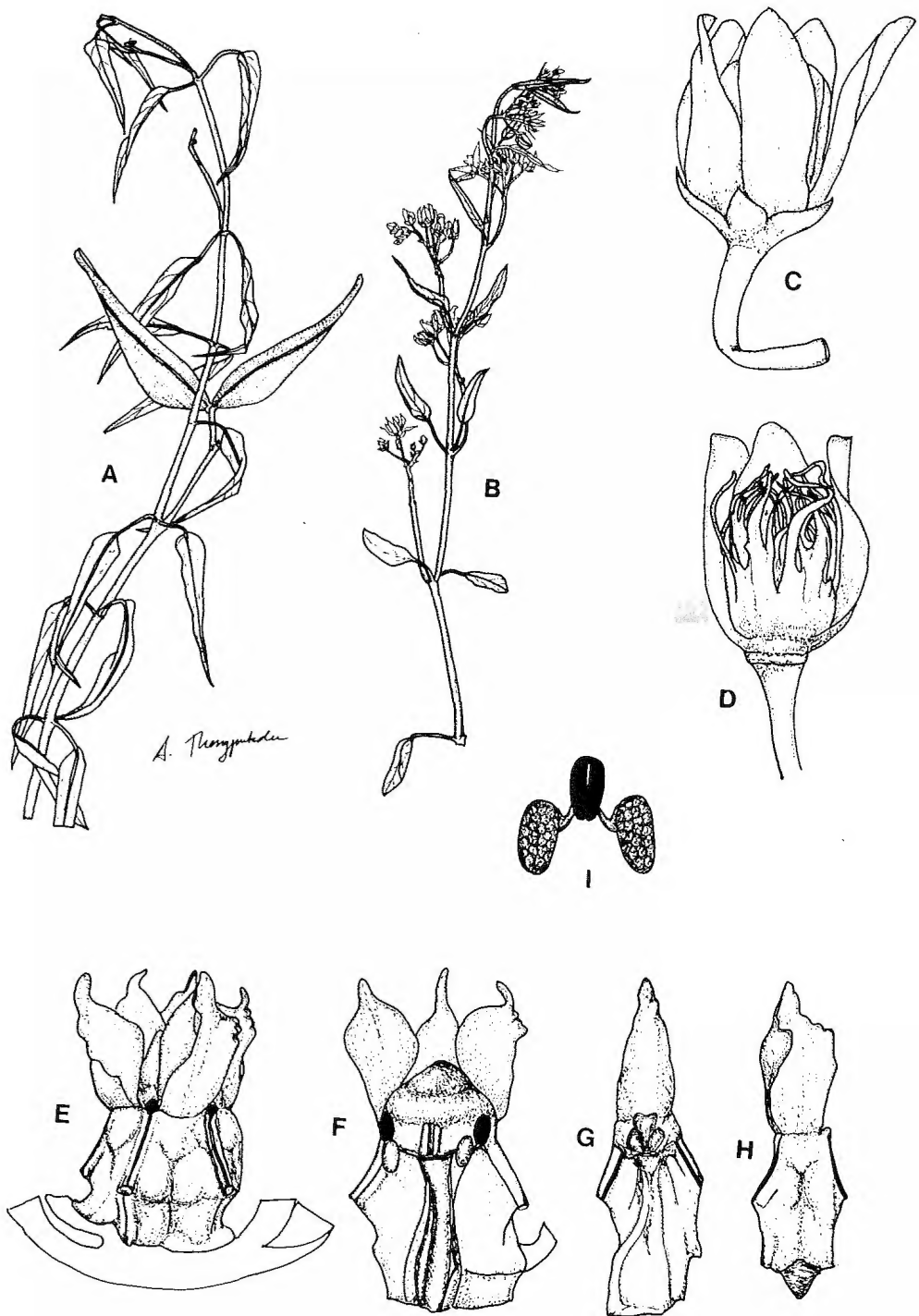


Fig. 2. *Cynanchum floribundum*: A. habit of fruiting branch $\times 0.25$. B. habit of flowering branch $\times 0.25$. C. side view of flower $\times 5$. D. side view of flower with corolla removed showing staminal corona $\times 5$. E. side view of staminal column with corolla and staminal corona removed $\times 10$. F. side view of staminal column with part removed showing the ovaries and disposition of the pollinaria $\times 10$. G. internal view of anther $\times 10$. H. external view of anther $\times 10$. I. pollinarium $\times 30$. All from spirit material of Olsen 176. Del. A. Thongpukdee.

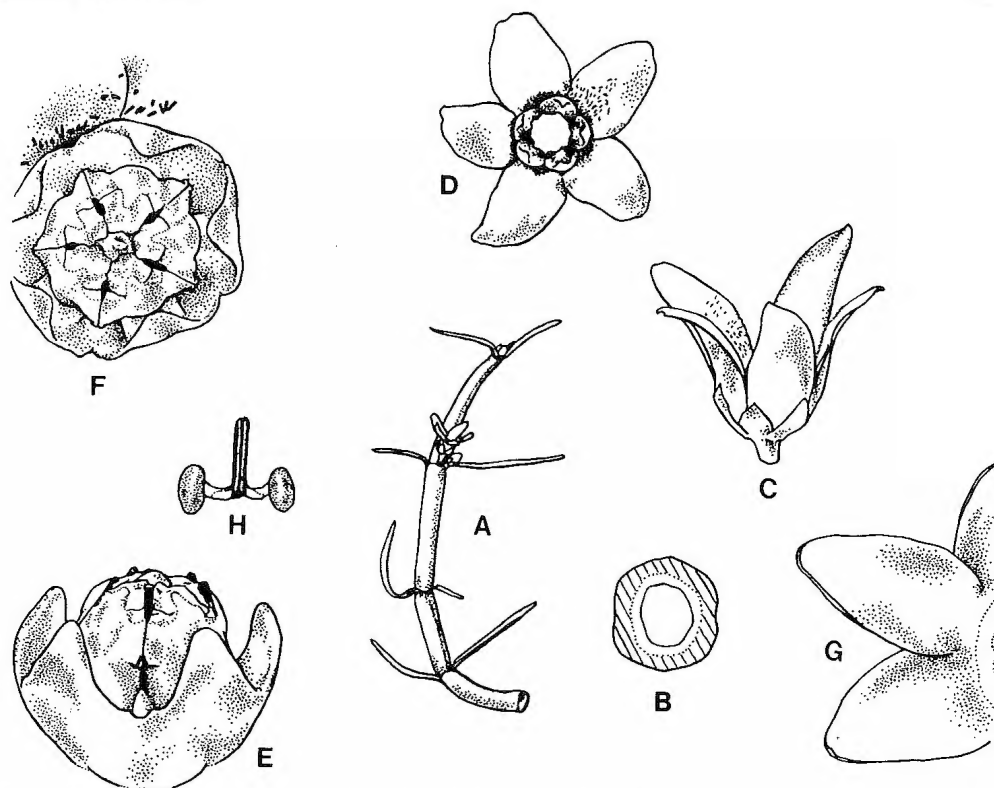


Fig. 3. *Cynanchum brachystelmoides*: A. habit $\times 1$. B. cross-section of stem showing hollow centre $\times 6$. C. side view of flower $\times 6$. D. face view of flower $\times 6$. E. side view of gynostegium $\times 18$. F. face view of gynostegium $\times 18$. G. face view of calyx with corolla removed $\times 18$. H. pollinarium $\times 37$. All from spirit material of Forster 4069 & Liddle. Del. K. Harold.

1.0 mm wide, glabrous. Flowers borne on top 1–6 nodes, in 1–7-flowered subsessile cymes. Flower campanulate, 2–4.5 mm long, 3–5 mm diameter, with a faint citrus scent; pedicels 1.5–2.5 mm long, filiform, pendulous during anthesis. Sepals broadly triangular to lanceolate, 1–1.5 mm long, 0.5–1 mm wide, glabrous; bases of sinuses lacking or with 1 gland. Corolla cream, brown or pink; tube c. 0.5 mm long, 1.5–2 mm diameter; lobes lanceolate to ovate, 1.5–4.5 mm long, 1–1.5 mm wide at base, glabrous. Staminal corona a continuous tube around the staminal column with 5 free erect lobes either overtopping the anthers, level with or below them, 1.25–1.5 mm diameter, 1–1.5 mm long; each lobe triangular, 0.25–0.75 mm long, 0.5–0.75 mm wide, green. Staminal column 0.3–1 mm long, 0.5–1.5 mm diameter; anther appendages ovate, 0.2–0.5 mm long, 0.2–0.5 mm wide; slit between anther wings 0.2–0.4 mm long. Style-head depressed-globose, not exceeding anthers, 0.4–0.75 mm diameter. Pollinarium 0.23–0.34 mm long, 0.28–0.4 mm wide; pollinia 0.14–0.15 mm long, 0.05–0.06 mm wide; corpusculum 0.20–0.27 mm long, 0.03–0.06 mm wide; caudicles 0.1–0.13 long, 0.02–0.03 mm wide. Follicles and seed not seen. Fig. 3.

Additional specimens examined: Papua New Guinea. WESTERN PROVINCE: Penzara, between Morehead and Wassi Kussa Rivers, Dec 1936, *Brass* 8448 (L). Australia. Queensland. COOK DISTRICT: 2.4 km W of Lydia Ck on the Mission River Road, 12°33'S, 142°34'E, *Clarkson* 8597 & *Neldner* (BRI,DNA,K,L,PERTH); "Batavia Downs", 12°40'S, 142°40'E, Dec 1988, *Bews* [AQ 455240] (BRI); 62.5 km along main Weipa road off Peninsula road, 12°56'S, 142°24'E, Apr 1988, *Forster* 4069 & *Liddle* (BRI,MEL).

Distribution and habitat: Western province in Papua New Guinea, Cook district in Queensland and the top end of the Northern Territory. The collection *Forster* 4069 & *Liddle* came from 30 cm deep water in a *Melaleuca* swamp. Along with *C. liebiana*, *C. brachystelmoides* appears to be able to tolerate aquatic conditions, at least for part of the year.

Additional notes: The flowering of this unusual species in cultivation has enabled a more detailed description and illustration to be published here. Considerable variation is present in the staminal corona with the tube and lobes varying in length. The coronal tube may extend to below the bottom of the anthers, as in the type and *Brass* 8396 as illustrated in Forster & Thongpukdee (1988) or it may nearly overtop them (Fig. 3E).

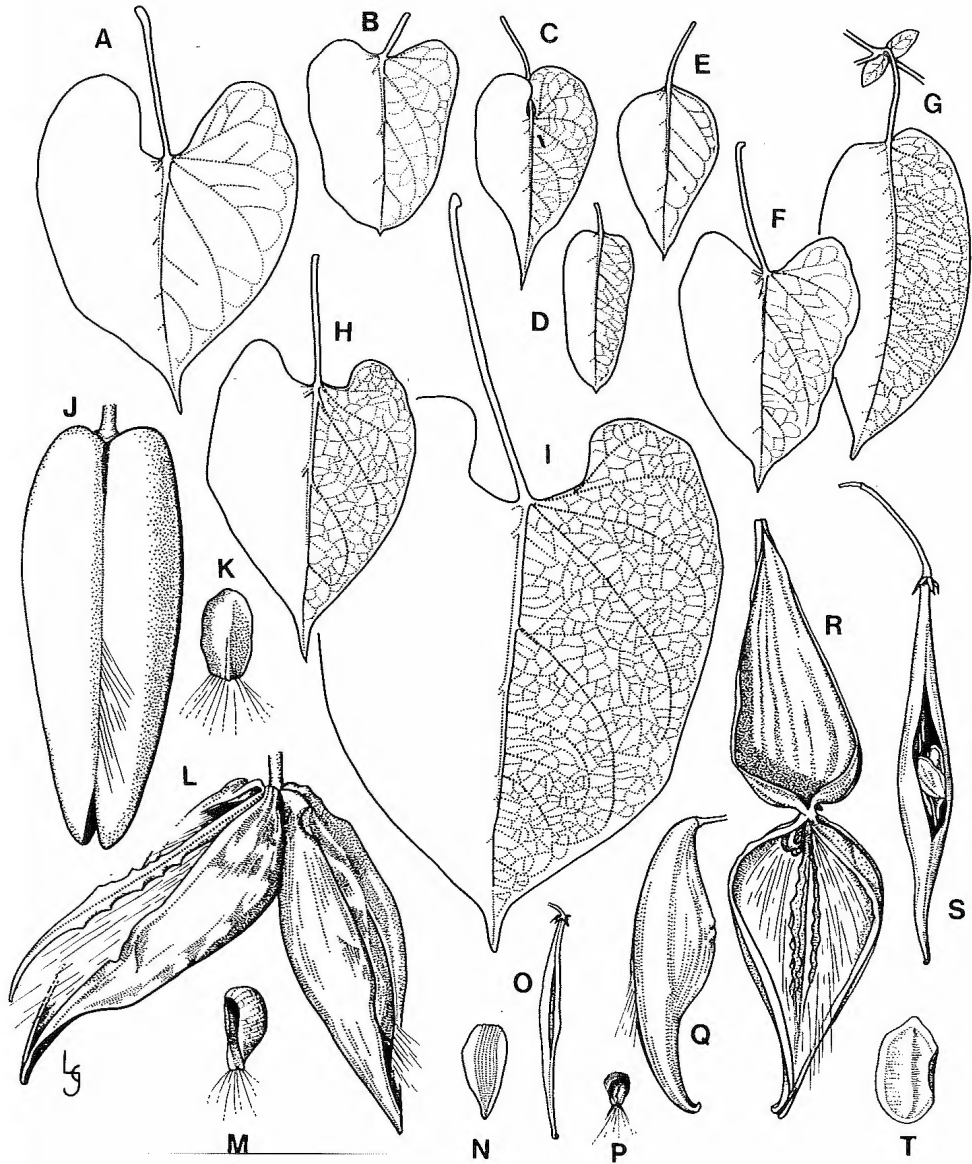


Fig. 4. A-C, L-M. *Cynanchum pedunculatum*: A. adaxial leaf surface $\times 0.5$. B. adaxial leaf surface $\times 0.5$. C. adaxial leaf surface $\times 0.5$. L. twin follicles $\times 1$. M. seed $\times 1.5$. D, J, K. *C. bowmanii*: D. adaxial leaf surface $\times 0.5$. J. follicle $\times 1$. K. seed $\times 1.5$. E. *C. elegans*: adaxial leaf surface $\times 0.5$. F, P-R. *C. puberulum*: F. adaxial leaf surface $\times 0.5$. P. seed $\times 1.5$. Q. side view of follicle $\times 1$. R. twin follicles viewed from above $\times 1$. G. *C. ovalifolium*: adaxial leaf surface $\times 0.5$. H, I. *C. leptolepis*: H. adaxial leaf surface $\times 0.5$. I. adaxial leaf surface $\times 0.5$. N, O. *C. christineae*: N. seed $\times 1.5$. O. follicle $\times 1$. S, T. *C. liebiana*: S. follicle $\times 1$. T. seed $\times 0.5$. A, Martense AE607; B, Russell-Smith 860; C, Holtze 34; D, Batianoff 9141 & Dillewaard; E, Wools [AQ 333122]; F, Mueller [AQ 333094]; G, Brass 8521; H, Russell-Smith 6924 & Lucas; I, Russell-Smith 6907; J, K, Batianoff 9126 & Dillewaard; L, M Scarth-Johnson 1569A; N, O, Cox [AQ 453003]; P-R, Vernon 62; S, T, Tingey [AQ 408482]. Del. L.G. Jessup.

5. *Cynanchum christineae* P. Forster, *Austrobaileya* 3: 112 (1989). **Type:** Northern Territory. Palmerston, 12°29'S, 130°58'E, December 1987, C. Cox [AQ408484] (holo: BRI!). **Fig. 40.**

See Forster (1989) for a description and notes on distribution, habitat, phenology and conservation status.

Additional specimens: Northern Territory. 41 km past Berry Springs on Mandorah road, 12°40'S, 130°45'E, Nov 1989, Forster 6056 (BRI); 8 km along "Finnis River" road, off Bynoe road, 12°46'S, 130°46'E, Nov 1989, Forster 6060 (BRI,DNA), Tabletop Range, 90 km S Darwin, 13°12'S, 130°47'E, Nov 1988, Wightman 4637 (DNA).

6. *Cynanchum elegans* (Benth.) Domin, *Biblioth. Bot.* 89: 1085 (1928); *Vincetoxicum elegans* Benth., *Fl. austral.* 4: 330–331 (1869). **Type:** New South Wales. Ash Island, Hunter River, Miss Scott (lecto (here designated): MEL(MEL 10080!); isolecto: BRI(AQ 216451!); lectopara: New South Wales. Cabramatta, Woolls (MEL(MEL 10079!), BRI(AQ 333123!)).

Herbaceous vine, latex colour unknown. Stems cylindrical, up to 1 mm diameter, glabrous; internodes up to 7 cm long. Leaves petiolate; lamina lanceolate-ovate, up to 4.5 cm long and 3.5 cm wide, discolorous; above green, venation obscure, glabrous; below pale green, secondary veins 3 or 4 per side of midrib, glabrous; tip acuminate; base cuneate; petiole grooved along top, up to 17 mm long; extrafloral nectaries 2 or 3 at lamina base. Cymes with 1 or 2 fascicles, up to 4 cm long; peduncles to 22 mm long and c. 1 mm diameter, glabrous; bracts triangular, 0.5–0.7 mm long, 0.3–0.5 mm wide, with sparse indumentum. Flower rotate, 5–6 mm long, 6–7 mm diameter; pedicels 13–15 mm long, 0.2–0.3 mm diameter, glabrous. Sepals lanceolate, 1–1.3 mm long, 0.7–1.1 mm wide, glabrous; bases of sinuses with 1 gland. Corolla colour unknown; tube c. 1 mm long, 2–3 mm diameter; lobes lanceolate, 5–6 mm long, 1.5–2.5 mm wide, externally glabrous, internally with scattered to sparse indumentum. Staminal corona of 5 lobes, c. 2 mm long and 2 mm diameter; each lobe triangular-lanceolate, not overtopping anthers, 1–2 mm long, 1–1.3 mm wide at base. Staminal column c. 1.5 mm long and 1.5 mm diameter; anther appendages ovate, 0.3–0.5 mm long, 0.7–0.75 mm wide; slit between anther wings c. 1 mm long. Style-head conical, c. 1 mm long and 1 mm diameter. Pollinarium 0.36–0.45 mm long, 0.50–0.57 mm wide; pollinia 0.22–0.23 mm long, 0.11–0.13 mm wide; corpusculum 0.25–0.30 mm long, 0.12–0.16 mm wide; caudicles 0.10–0.15 mm long, 0.02–0.05 mm wide. Follicles and seed not seen. **Fig. 4E.**

Specimen examined: New South Wales. Berkeley Hill, Berkeley, S of Wollongong, Apr 1990, Bofeldt (BRI).

Distribution and habitat: This plant is known to occur only near Wollongong (**Map 1**). Leigh *et al.* (1984) report a further collection made by Rodd in 1966 at Mt Dangar near Gungah, but I have not seen this. The Bofeldt collection was made in a 'dry rainforest' remnant and the plant grew in association with *Sarcomelicope simplicifolia* (Endl.) T. Hartley, *Ficus macrophylla* Desf., *Streblus brunonianus* (Endl.) F. Muell. and *Cassine australis* (Vent.) Kuntze.

Phenology: Flowering in April.

Conservation status: A Conservation Coding of 3E is appropriate according to the criteria of Briggs & Leigh (1988).

7. *Cynanchum bowmanii* S.T. Blake, *Proc. Roy. Soc. Queensland* 59: 168 (1948). **Type:** as for *V. ovatum* Benth.

Vincetoxicum ovatum Benth., *Fl. austral.* 4: 330 (1869); *Cynanchum ovatum* (Benth.) Domin, *Biblioth. Bot.* 89: 1085 (1928), non (E. Mey.) Druce, *Rep. Bot. Exch. Cl. Brit. Isl.* 1916: 618 (1917). **Type:** Queensland. MORETON DISTRICT: Moggill Scrub, C. Stuart 381 (lecto (here designated): K, n.v., photo at BRI!; isolecto: MEL(MEL 113316 in part!), BRI(AQ 333121!)); lectopara: Queensland. PORT CURTIS DISTRICT: Table Mountain, Bowman (MEL(MEL 113315!), BRI(AQ 333125!)); lectopara: Queensland. MORETON DISTRICT: Brisbane River, F. Mueller (K, n.v., photo at BRI!), MEL(MEL 113316 in part!); lectopara: Queensland. PORT CURTIS DISTRICT: Rockhampton, Thozet (K, n.v., photo at BRI!).
Bailey, *Queensl. fl.* 3: 1000 (1900); Stanley & Ross, *Fl. S.E. Queensl.* 2: 312 (1986).

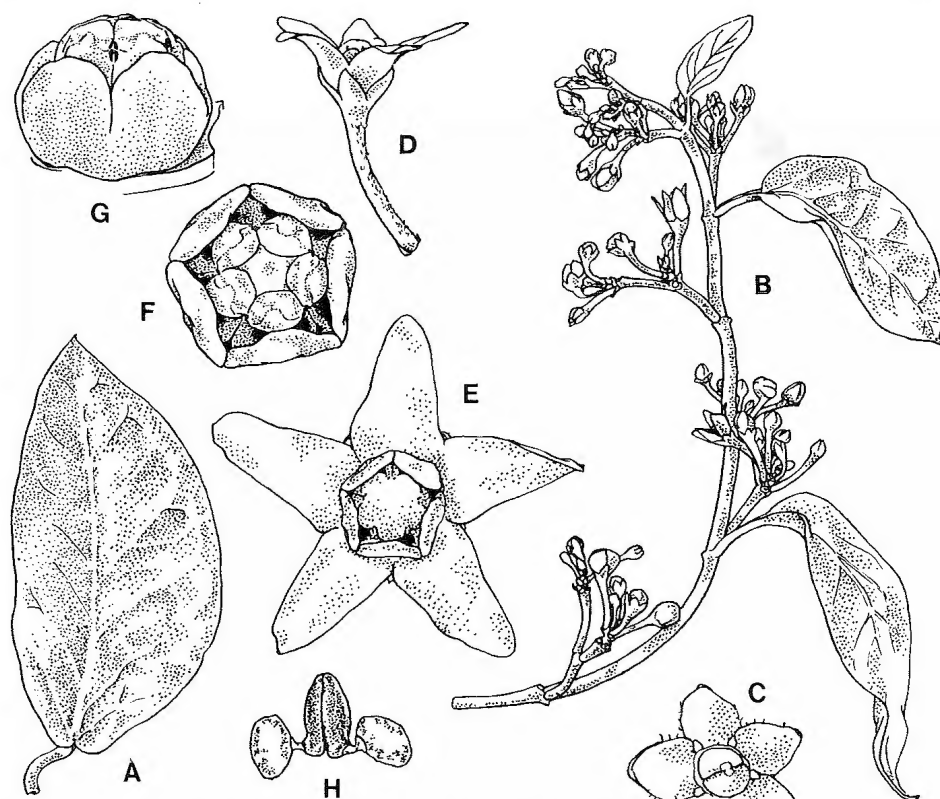


Fig. 5. *Cynanchum bowmanii*: A. leaf $\times 1$. B. habit of flowering stem $\times 1$. C. face view of calyx and ovaries with corolla removed $\times 6$. D. side view of flower $\times 3$. E. face view of flower $\times 6$. F. face view of gynostegium $\times 9$. G. side view of gynostegium $\times 9$. H. pollinarium $\times 40$. All from spirit material of Forster 2407. Del. K. Harold.

Herbaceous vine, latex white. Stems cylindrical, up to 1 mm diameter, glabrous or with sparse indumentum; internodes up to 4 cm long. Leaves petiolate; lamina lanceolate, ovate to elliptic, up to 8.5 cm long and 3 cm wide, discolorous; above green, venation obscure, glabrous; below pale green, secondary veins 6 or 7 per side of midrib, glabrous with scattered indumentum on veins; tip acute; base cuneate; petiole grooved along top, up to 15 mm long and c. 1 mm wide; extrafloral nectaries 3–4 at lamina base. Cyme with 1–6 fascicles, up to 5 cm long; peduncle 8–20 mm long, 0.5–1 mm diameter; bracts linear-lanceolate, 0.75–1.5 mm long, c. 0.5 mm wide, with sparse indumentum. Flowers rotate, 2–3 mm long, 7–8 mm diameter; pedicels 4–13 mm long, 0.5–0.75 mm diameter, with sparse indumentum. Sepals lanceolate to lanceolate-ovate, 1.5–2 mm long, 0.9–1 mm wide, glabrous; bases of sinuses lacking glands. Corolla cream; tube c. 1 mm long, 2.5–3 mm diameter; lobes lanceolate to oblong, 3–4 mm long, 1.5–2 mm wide, glabrous. Staminal corona cream, c. 1.5 mm long, 2.5–3 mm diameter, comprising 5 adjacent but not fused lobes attached to base of staminal column; each lobe with a rectangular base and with a rounded to irregularly shaped top, 1.25–1.5 mm wide. Staminal column c. 1.5 mm long, 1.5–2.5 mm diameter; anther appendages ovate, c. 0.5 mm long, 0.5–0.75 mm wide; slit between anther wings 0.5–0.75 mm long. Style-head conical, globose, barely exceeding anthers, c. 1 mm long, 1–1.5 mm diameter. Ovaries c. 1.5 mm long, 1–1.5 mm wide. Pollinarium 0.35–0.38 mm long, 0.4–0.5 mm wide; pollinia oblong to globose, 0.2–0.21 mm long, 0.12–0.16 mm wide; corpusculum oblong, 0.2–0.27 mm long, 0.08–0.12 mm wide; caudicles 0.07–0.09 mm long, 0.03–0.04 mm wide. Follicles fusiform-ovoid, 6–9.5 cm long, 1.5–2.5 cm wide. Seed ovate, c. 7 mm long and 4 mm wide; coma 20–24 mm long, white. Fig. 4D, 5 & 6.

Selected specimens. Queensland. NORTH KENNEDY DISTRICT: Rishton Scrub, 20°09'S, 146°32'E, Mar 1988, Forster 3764 (BRI, MEL, MO). SOUTH KENNEDY DISTRICT: 2 km SW Eungella Dam, Byrnes 3692 & Clarkson (BRI); Ayr, Michael 1532 (BRI); Mausoleum Is, 20°52'S, 148°57'E, Dec 1986, Dalliston N333 (BRI). PORT CURTIS DISTRICT:

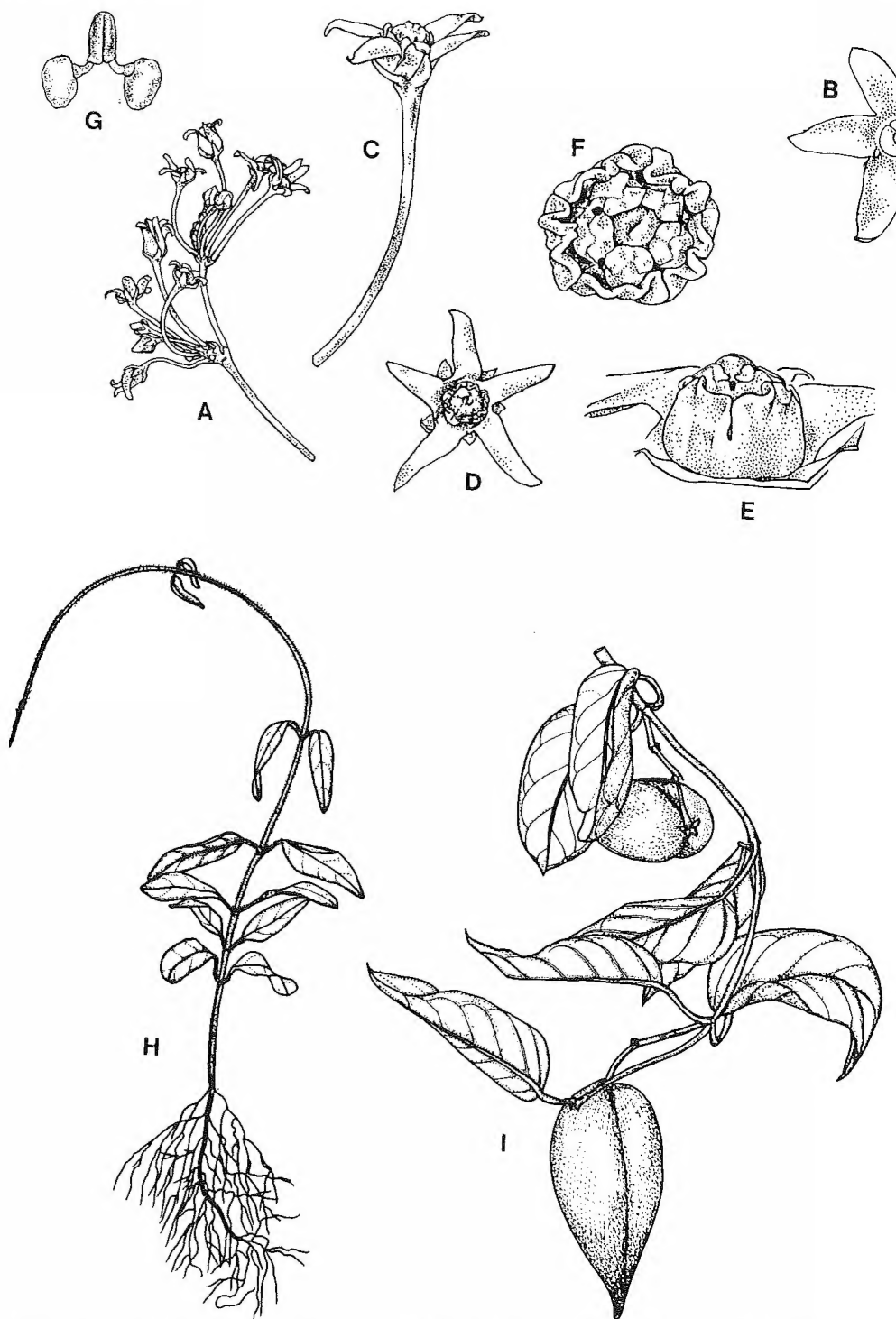


Fig. 6. *Cynanchum bowmanii*: A. inflorescence $\times 1$. B. face view of calyx and ovaries with corolla removed $\times 7$. C. side view of flower $\times 3$. D. face view of flower $\times 3$. E. side view of flower with corolla cutaway showing gynostegium (note variation in corona lobes) $\times 9$. F. face view of gynostegium (note variation in corona lobes) $\times 11$. G. pollinarium $\times 40$. H. seedling $\times 1$. I. fruiting branch $\times 2$. A-G, Forster 3764; H, Forster 3480; I, Bird s.n. Mar. 1986. A-G, Del. K. Harold; H, I. Del. A. Thongpukdee.

East Pumpkin Is, 23°05'S, 150°54'E, Oct 1987, *Batianoff* 9141 & *Dillewaard* (BRI); Dan Dan Scrub, Mar 1982, *Gibson* 333 (BRI); Marmor, Mar 1943, *Blake* 14824 (BRI). LEICHHARDT DISTRICT: Gogango Range, near Edungalba, Sep 1943, *Blake* 15340 (BRI). BURNETT DISTRICT: Boat Mt, 8 km NNE of Murgon, 26°10'S, 151°58'E May 1988, *Forster* 4266 & *Sharpe* (BRI); Mt Perry, *Keys* [AQ 216450] (BRI). WIDE BAY DISTRICT: Mt Glastonbury, 26°14'S, 152°29'E, Jan 1987, *Forster* 2872 & *Sharpe* (BRI); Stony Ck, near Didcot, Dec 1981, *Forster* 472B (BRI). DARLING DOWNS DISTRICT: 5.5 km SW of Baking Board, 26°44'S, 150°31'E, Feb 1978, *Hando* [AQ 408485] (BRI); Mt Russel, 16 miles [27 km] SW of Oakey, Apr 1963, *Hockings* 10 (BRI). MORETON DISTRICT: Worlds End Pocket, 27°31'S, 152°45'E, Aug 1983, *Forster* 1666 (BRI); Pine Mt, near Ipswich, Apr 1984, *Bird* [AQ 431091] (BRI, CONN, NSW, SP); Mt Crosby road, between Anstead & Mt Crosby, Dec 1985, *Bird* [AQ 441683] (BRI, GUAM, GNU, NSW, UPNG); Top of Flinders Peak, 27°49'S, 152°49'E, Nov 1986, *Forster* 2732 & *Orford* (BRI); Ivorys Knob, 27°53'S, 152°48'E, Dec 1987, *Bird* & *Orford* [AQ 459646] (BRI); 11 km from Croftby on White Swamp to Boonah Border Gate road, 28°10'S, 152°32'E, Feb 1985, *Forster* 1981 (BRI).

Distribution and habitat: This species occurs from near the Queensland-New South Wales border to the Charters Towers area (Map 3) and grows in a range of drier vineforest communities, especially in semi-evergreen vine thickets, deciduous vine thickets, araucarian microphyll and notophyll vineforests on a range of soil types. *C. bowmanii* may grow in association with other Asclepiadaceous vines such as *Tylophora benthamii* Tsiang, *T. grandiflora* R. Br., *T. williamsii* P. Forster ined., *Gymnema micradenium* Benth., *G. pleiadenium* F. Muell. *Secamone elliptica* R. Br., *Marsdenia rostrata* R. Br. and *M. lloydii* P. Forster.

Phenology: Flowering from November to March, fruiting 2–3 months later.

Conservation status: Not rare or endangered.

Notes: The MEL specimen of the Bowman collection has two labels, one has "Table Mountain, Feb 1867", the other has "Capricornia, Q". The sheet MEL 113316 appears to have both the Moggill Scrub and Brisbane River isosyntypes attached.

8. *Cynanchum leptolepis* (Benth.) Domin, Biblioth. Bot. 89: 1085 (1928); *Vincetoxicum leptolepis* Benth., Fl. austral. 4: 331 (1869). Type: Queensland. SOUTH KENNEDY DISTRICT: Elliot River *Bowman* 337 (lecto (here designated): K, *n.v.*, photo at BRI; isolecto: BRI(AQ 333127!), MEL(MEL 113314!)); lectopara: Queensland. SOUTH KENNEDY DISTRICT: Mount Elliot, *Fitzalan* (BRI(AQ 333129!), MEL(MEL 113313!)). Bailey, Queensl. fl. 3: 1000 (1900).

Woody vine, latex white. Stems cylindrical, up to 2 mm diameter, with sparse to dense indumentum; internodes up to 20 cm long. Leaves petiolate; lamina ovate, up to 17 cm long and 14 cm wide, discolorous; above grey-green, venation obscure, glabrous; below pale grey-green, secondary veins 5 or 6 per side of midrib with 3 radiating from the lamina base, tertiary venation reticulate, glabrous or with sparse indumentum; tip acute to weakly acuminate; base cordate to lobate; petiole grooved along top, 4–8 cm long, 1–2 mm diameter, with sparse to dense indumentum; extrafloral nectaries 6–13 at base of lamina and sometimes for up to 1 cm along the midrib. Cyme with many fascicles, up to 8 cm long; peduncle 3.5–5.7 cm long and c. 1 mm diameter, glabrous or with scattered to sparse indumentum; bracts linear-lanceolate, 1–2.5 mm long, 0.25–0.75 mm wide with scattered to sparse indumentum. Flower campanulate, 4–5 mm long, c. 5 mm diameter; pedicels 4–7 mm long, 0.25–1 mm diameter, glabrous. Sepals triangular to lanceolate, 2–3 mm long, 0.8–1.5 mm wide, glabrous or with scattered to sparse indumentum; bases of sinuses with 1–2 glands. Corolla cream; tube 2.5–3 mm long, 2.5–3 mm wide, top fused to base of staminal corona; lobes lanceolate-ovate, reflexed, 2.1–3 mm long, 1.4–1.6 mm wide, glabrous. Staminal corona of 5 separate lobes, 3–5 mm long, 2.5–3.5 mm diameter; each lobe oblong with a subulate tip, 0.5–1 mm wide at base, 0.2–0.3 mm wide at tip, incurving over staminal column. Staminal column 1–2.7 mm long, 1.5–2.3 mm wide; anther appendages ovate, 0.5–0.75 mm long, 0.8–1 mm wide; slit between anther wings 0.5–0.6 mm long. Style-head depressed, globose, barely exceeding anthers, 0.7–1.5 mm long, 1.5–1.8 mm wide. Ovaries 1–1.1 mm long and 1–1.5 mm wide. Pollinarium 0.4–0.6 mm long, 0.65–0.72 mm wide; pollinia oblong, 0.37–0.42 mm long, 0.15–0.17 mm wide; corpusculum 0.2–0.25 mm long, 0.1–0.17 mm wide; caudicles 0.18–0.2 mm long, 0.02–0.05 mm wide. Follicles fusiform-ovoid 5–6 cm long, 12–15 mm diameter, with sparse to dense short indumentum. Seed not seen. **Figs 4H,I & 7.**

Specimens examined: Northern Territory, Headwaters Woolen River, Arnhem Land, 12°30'S, 135°24'E, Dec 1987, *Russell-Smith* 4410 & *Lucas* (DNA); 11 km SE Calvert River mouth, 16°21'S, 137°48'E, Jan 1989, *Thomson* 3013 (DNA); 17 km E Calvert River mouth, 16°23'S, 137°47'E, Jan 1989, *Thomson* 3005 (DNA); 15 km SE Calvert

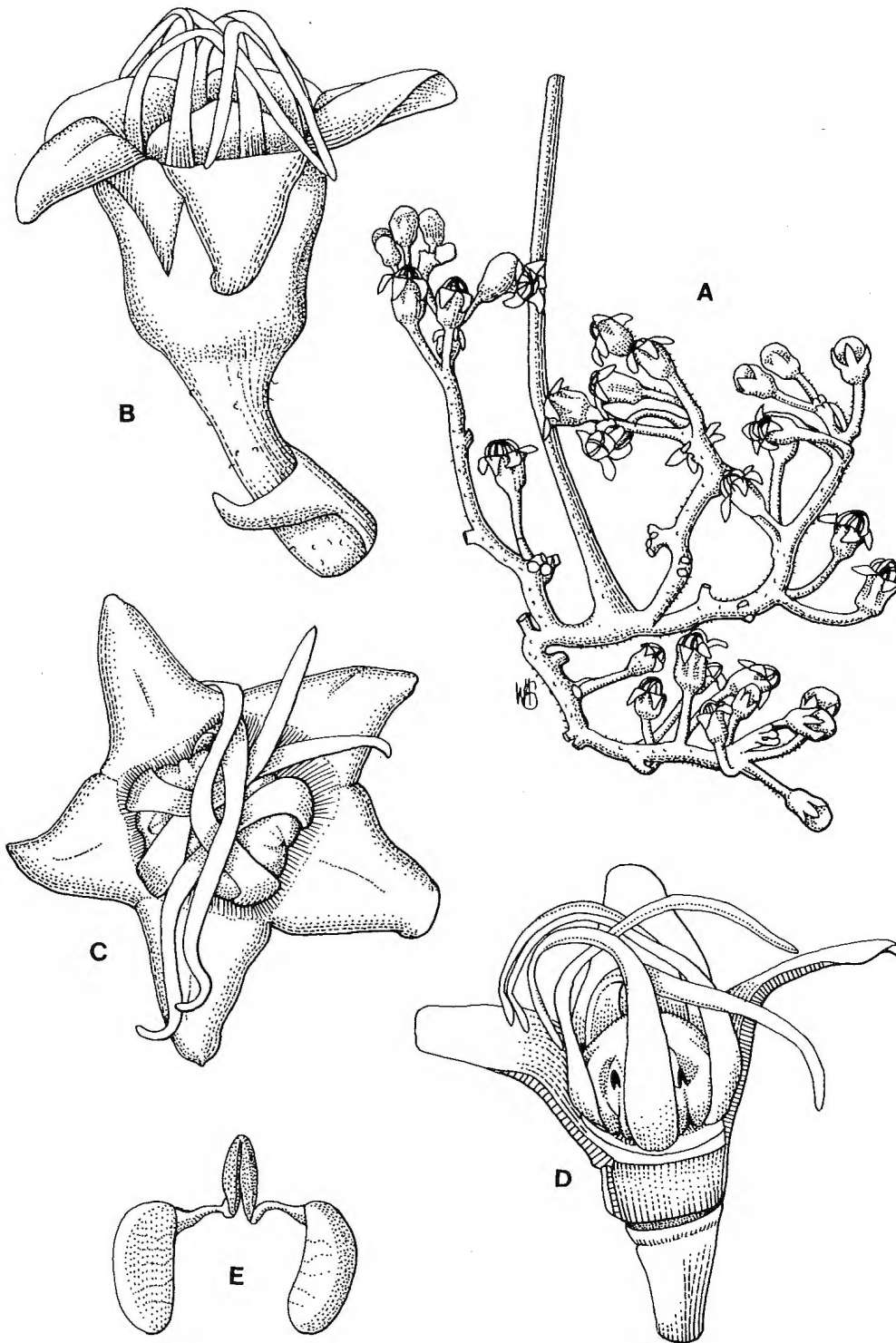


Fig. 7. *Cynanchum leptolepis*: A. inflorescence $\times 2$. B. side view of flower $\times 6$. C. face view of flower $\times 6$. D. side view of flower with corolla and sepals cutaway showing gynostegium and corona $\times 6$. E. pollinarium $\times 50$. All from spirit material of Russell-Smith & Lucas 6294. Del. W. Smith.

River mouth, 16°23'S, 137°50'E, Jan 1989, *Russell-Smith & Lucas* 6907 (DNA); 4 km S of Spear Waterhole, "Wollogorang", 17°25'S, 137°43'E, Jan 1989, *Russell-Smith & Lucas* 6849 (DNA); McDermotts Spring, "Wollogorang", 17°25'S, 137°48'E, Jan 1989, *Russell-Smith & Lucas* 6294 (BRI,CANB,DNA); "Wollogorang", c. 35 km SW HS, 17°26'S, 137°43'E, Jan 1989, *Brock* 468 (DNA). **Queensland.** COOK DISTRICT: Pine River Basin, 12°31'S, 141°39'E, Feb 1981, *Morton* 1086 (BRI); Walsh, Mar 1891, *Barclay-Millar* [AQ 216488] (BRI); 8.3 km S of Weipa turnoff, on Peninsula road, 13°11'S, 142°47'E, Apr 1988, *Forster* 4122 & *Liddle* (BRI); Bamboo Range, 19 km past Musgrave on Coen road, 14°38'S, 143°27'E, Jun 1989, *Forster* 5229 (BRI); Burdett Ck, next to Spring Tower, Chillagoe, 17°08'S, 144°26'E, Apr 1988, *Forster* 3962 (BRI,CANB,MEL); The Archways, Chillagoe, 17°06'S, 144°24'E, Mar 1988, *Forster* 3959 (BRI), ditto, Mar 1987, *Clarkson* 6863 (BRI,MBA); Mt Pinnacle, 17°14'S, 145°30'E, Mar 1986, *Sankowsky* 497 & *Sankowsky* (BRI). SOUTH KENNEDY DISTRICT: Port Mackay, 1865–1869, *Dietrich* 2804 (BRI,CBG).

Distribution and habitat: This species is restricted to north Queensland and eastern Arnhem Land and the Gulf of Carpentaria in the Northern Territory (Map 2) where it may be a common component of deciduous vine thickets. *C. leptolepis* may grow in association with other Asclepiadaceous vines such as *Gunnesia pepo* P. Forster, *Gymnema geminata* R. Br., *Marsdenia cymulosa* Benth., *M. velutina* R. Br., *Ceropegia cumingiana* Decne., *Secamone elliptica* and *S. lineata* Blume.

Phenology: Flowering from November to March, fruiting 2–3 months later.

Notes: Plants of *C. leptolepis* from the limestone tors at Chillagoe are notable for the thick indumentum of white hairs present on the foliage. This is common among many plants in the area and no taxonomic significance is given to it here, particularly because plants cultivated away from this environment do not retain this feature.

Conservation status: Rarely collected, but not rare or endangered at this stage.

9. *Cynanchum ovalifolium* Wight, Contrib. bot. India 57 (1838); *Cynoctonum ovalifolium* (Wight) Decne. in DC., Prodr. 8: 529 (1844). **Type:** India. Penang, Aug 1827, (holo: K-W(8226), n.v., fiche at BRI!).

J.D. Hook., Fl. Brit. India 4: 22–23 (1885); Bakhuizen van den Brink, Blumea 6: 369 (1950); Backer & Bakhuizen van den Brink, Fl. Java 3: 253 (1965).

Cynanchum laeve (Blume) Schumann, Nat. Pflanzenfam. 4(2): 292 (1897) non Persoon, Syn. 1: 27 (1805); *Holostemma laeve* Blume, Bijdr. 1055 (1826); *Cynoctonum blumei* Decne. in DC., Prodr. 8: 528–529 (1844). **Type:** Indonesia. Java. Sallak, Blume (holo: L(898166–426!)). Koord., Exkurs.-Fl. Java 3: 85 (1912).

Cynanchum javanicum (Koord.) Bakhuizen van den Brink, Blumea 6: 369 (1950); *Marsdenia javanicum* Koord. in Koord.-Schumach., Syst. Verz. 1: 8 (1912); **synon. nov.** **Type:** Indonesia. Java. Besechi, Gendingwaloh, Aug 1916, *Koorders* 43102β (syn: BO n.v.; isosyn: L!); Indonesia. Java. Res. Bezoeki, Pantjoer Tdjen, Dec 1898, *Koorders* 32271β (syn: BO n.v.; isosyn: L!); Indonesia. Java. Res. Bezoeki, Pantjoer Tdjen, Nov 1895, *Koorders* 20346β (syn: BO n.v.; isosyn: L!). Koord., Exkurs.-Fl. Java 3: 104 (1912); Backer & Bakhuizen van den Brink, Fl. Java 2: 253 (1965).

Vincetoxicum discolor Warb., Bot. Jahrb. Syst. 13: 469 (1891), **synon. nov.** **Type:** "Sigar am McCluersgolf, holl. Neu-Guinea" (B†).

Herbaceous vine, latex white. Stems cylindrical, up to 2 mm diameter, grey-green; internodes up to 12 cm long, small stipule like structures at nodes or occasionally leaflike stipular structures to 1 cm long at nodes. Leaves petiolate; lamina ovate-lanceolate to lanceolate, up to 12 cm long and 7 cm wide, discolorous; above dark green, venation obscure, glabrous; below pale green, secondary veins 10–13 per side of midrib, tertiary venation obscure, glabrous apart from a few white uniseriate hairs at base and along peduncle; tip acuminate; base cordate to cuneate; petiole grooved along top, 28–32 mm long, c. 1 mm diameter; extrafloral nectaries 2 at lamina base. Flowers borne on top 2–10 nodes. Cymes comprising 1–10 fascicles, up to 10 cm long; peduncle to 37 mm long, c. 1 mm diameter, with scattered to sparse indumentum, green. Flowers rotate, c. 4 mm long, 6–7 mm diameter; pedicels 4–7 mm long, c. 1 mm diameter, with scattered to sparse indumentum. Sepals ovate, c. 1.5 mm long and 1.5 mm wide, green, ciliate, externally with sparse to dense indumentum; bases of sinuses with 1 gland. Corolla tube cream, 1–1.5 mm long, c. 3 mm diameter, glabrous; lobes ovate-oblong, 4–5 mm long, 1–3 mm wide, somewhat pouched in middle, with brown-red and yellow-cream alternate striping, glabrous. Staminal corona c. 3 mm long, 4–5 mm diameter, tubular with c. 15

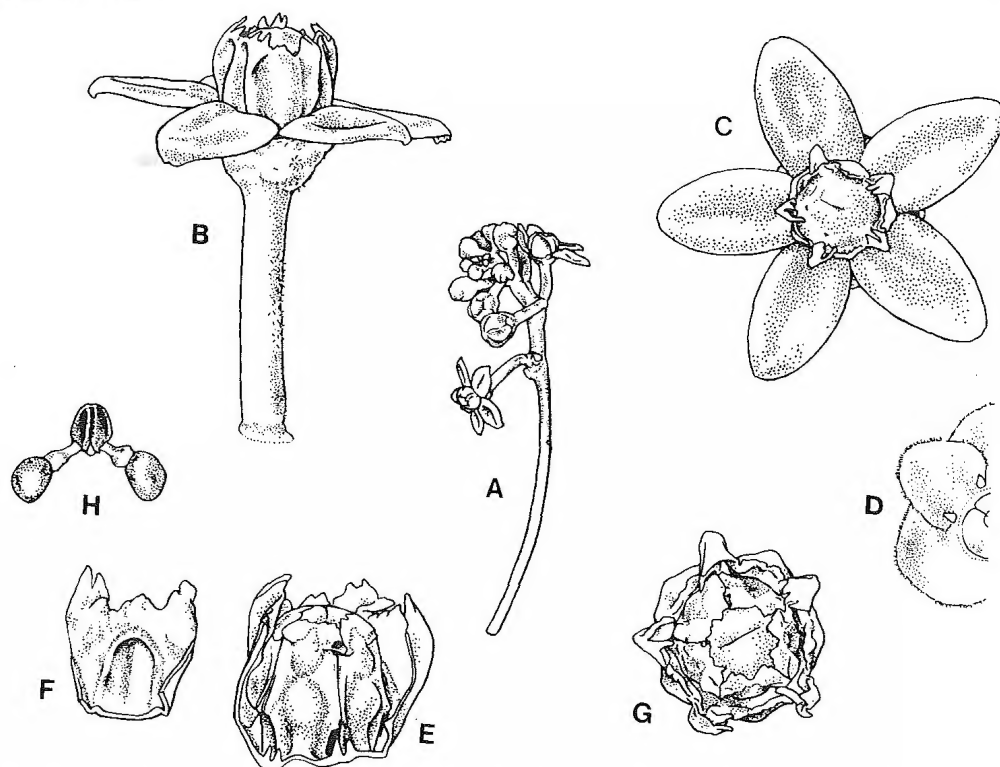


Fig. 8. *Cynanchum ovalifolium*: A. inflorescence $\times 1$. B. side view of flower $\times 4$. C. face view of flower $\times 4$. D. face view of calyx and ovaries with corolla removed $\times 6$. E. side view of gynostegium with partial removal of tubular corona $\times 6$. F. cut-away portion of tubular corona $\times 6$. G. face view of gynostegium $\times 6$. H. pollinarium $\times 18$. All from spirit material of Forster 4090 & Liddle. Del. K. Harold.

irregular lobes, tubular portion c. 2 mm long, lobes up to 1 mm long; two lobes opposite each corpusculum and 1 lobe between each pair. Staminal column c. 2.5 mm long, 2–2.5 mm diameter; anther appendages triangular to ovate-truncate, 0.6–1 mm long, c. 1 mm wide; slit between anther wings 1–1.5 mm long. Style-head conical, globose, 1–1.5 mm long, c. 2 mm diameter. Ovaries c. 2.5 mm long, 1–2 mm wide. Pollinarium 0.6–0.8 mm long, 0.8–1.1 mm wide; pollinia ellipsoid, 0.35–0.37 mm long, 0.22–0.31 mm wide; corpusculum oblong, 0.3–0.35 mm long, 0.2–0.22 mm wide; caudicles 0.17–0.27 mm long, 0.06–0.1 mm wide at end joining corpusculum, 0.16 mm wide at end joining pollinium. Follicles fusiform-ovoid, 7–8.5 cm long, 3–3.5 cm wide. Seed ovate, 6–7 mm long, c. 4 mm wide; coma 2–2.5 cm long, white. Figs 4G & 8.

Selected specimens. Indonesia. Halmahera Sosoepae Kp. Taraeba, Oct 1937, *Nedi* 210 (L); Ambon, Kampong Koeda mati, Apr 1918, *Rornassi* 1111 (L); Kiakalan. P. Rakala, Oct 1951, *van Borssum Waalkes* 914 (L). Java. G. Muria, Mt Argodjembangan, Nov 1951, *Kostermans* 6313 (L); Batavia, Buitenzorg, Pasir Honje, Jun 1928, *Bakhuizen van den Brink* 7365 (BRI). Irian Jaya. path from Pocan Bay to Fofak Bay, Waigeo Island, Feb 1955, *van Royen* 5544 & 5542 (CANB,L); Cycloop Mts, hills E of Koejaboe River, Jun 1961, *van Royen & Sleumer* 5828 (A,L). Papua New Guinea. MADANG PROVINCE: Road no. 1, near Mauan Village, Gogol Valley, 5°13'S, 145°35'E, Jan 1977, *Wiakabu et al.* LAE70370 (BRI). EAST SEPIK PROVINCE: Cape Wom International Park, c. 8 km NW of Wewak town, 3°35'S, 143°35'E, Jan 1976, *Wiakabu & Yefle* LAE70312 (A,BRI,L); Passam, 3°48'S, 148°35'E, Mar 1989, *Hawkeswood* [AQ 470255] (BRI). MOROBE PROVINCE: Morobe, Dec 1947, *Womersley* NGF2936 (BRI); Markham Point, c. 7 miles [12 km] W of Lae, Oct 1963, *Hartley* 12255 (A,CANB). WESTERN PROVINCE: Tarara, Wassi Kussa River, Dec 1936, *Brass* 8521 (BRI). MILNE BAY PROVINCE: Menapi, Cape Vogel Peninsula, Mar 1953, *Brass* 21732 (A). AUSTRALIA. QUEENSLAND. COOK DISTRICT: Cape York, near Wilderness Lodge, Mar 1984, *Jacks* [AQ 437902] (BRI,JCT); near Ginger Mick's Mine, 2 km S of Punsand Bay, 10°45'S, 142°28'E, Jun 1988, *Forster* 4447 & *Liddle* (BRI,CBG,QRS); Kennedy Hill Gorge, 12°28'S, 143°16'E, Jun 1989, *Forster* 5383 (BRI); Tin Ck, 12°29'S, 143°11'E, Jun 1988, *Forster* 4592 & *Liddle* (BRI,CANB,DNA,K,L,MO); Iron Range, Jun 1948, *Brass* 19238 (A,BRI); c. 1.5 km upstream Brown Ck crossing, road to Lockhart River Mission, 12°46'S, 143°07'E, Apr 1988, *Forster* 4090 & *Liddle* (BRI,K); Chester River, 13°40'S, 143°25'E, Jul 1977, *Hyland* 9460 (BRI,QRS).

Distribution and habitat: *C. ovalifolium* occurs from the Indian subcontinent, through Malesia to New Guinea and far north Queensland in Australia. In Australia (Map 3),

this species grows in seasonally deciduous vineforest communities. *C. ovalifolium* may commonly grow in association with *Gunnessia pepo*, *Gymnema tricholepis* Schltr., *Marsdenia velutina*, *Secamone elliptica* and *S. lineata*.

Phenology: Flowering from November to February, fruiting 2–3 months later.

Notes: The original description of *Vincetoxicum discolor* Warb. applies to this taxon. Its name is placed in synonymy with *C. ovalifolium* on this basis.

Conservation status: Not rare or endangered in any way.

10. *Cynanchum puberulum* F. Muell. ex Benth., Fl. austral. 4: 333 (1869). *Vincetoxicum puberulum* (F. Muell. ex Benth.) O. Kuntze, Revis. gen. pl. 2: 425 (1891). Type: Northern Territory. Rocks, Upper Victoria River, *F. Mueller* (holo: K, 2 sheets, *n.v.*, photo at BRI!; iso: MEL(MEL 113331!), BRI!).

Herbaceous vine, latex white. Stems cylindrical, up to 2 mm diameter, with dense silver indumentum; internodes up to 18 cm long, small stipule like outgrowths at nodes, or occasionally leaflike stipular outgrowth at node. Leaves petiolate; lamina ovate-cordate, up to 11 cm long and 9 cm wide, discolorous; above grey-green, venation obscure, with sparse to dense silver indumentum; below pale grey-green, secondary veins 4–6 per side of midrib, with dense silver indumentum; tip acuminate; base strongly cordate; petiole grooved along top, 13–40 mm long, 0.05–1 mm diameter; extrafloral nectaries 6–11 at lamina base. Flowers borne on top 2–10 nodes. Cymes of 1–6 fascicles, up to 30 mm long; peduncle to 50 mm long, 1–1.5 mm diameter, with sparse indumentum; bracts linear-lanceolate, 1.5–2 mm long, 0.25–0.5 mm wide. Flower rotate, c. 10 mm long and 18 mm diameter; pedicels 3–12 mm long, 0.25–1 mm diameter, with sparse indumentum. Sepals lanceolate to lanceolate-oblong 1.5–5 mm long, 0.5–2.5 mm wide, with sparse indumentum; bases of sinuses with 1–2 glands. Corolla cream; tube c. 2 mm long and 5 mm diameter; lobes oblong-lanceolate to lanceolate, recurved, 2.5–8 mm long, 0.5–3.5 mm wide, glabrous. Staminal corona cream, tubular with 5 groups of lobes that intertwine above the style-head; tubular portion comprising 5 ovate, acute tipped lobes fused at edges, c. 2.5 mm long, 3–4 mm diameter; erect free lobes in groups of 4 or 5 (total of 20–25), linear-subulate, each lobe 3–5 mm long. Staminal column c. 3 mm long and 3 mm diameter, cream; anther appendages ovate, c. 1.5 mm long and 1.5 mm wide; slit between anther wings c. 1.5 mm long. Style-head conical, c. 1.5 mm long and 1.5 mm wide, not greatly exceeding anthers. Pollinarium c. 0.75 mm long and 1 mm wide; pollinia oblong, c. 0.5 mm long and 0.25 mm wide; corpusculum oblong, c. 0.32 mm long and 0.16 mm wide; caudicles attached to bottom of corpusculum, c. 0.20 mm long and 0.16 mm wide. Ovaries c. 3 mm long and 2.5 mm wide. Follicles fusiform-ovoid, 50–80 mm long, 20–30 mm diameter. Seed boat-shaped, papillate, 5–6 mm long, 2–4 mm wide; coma 25–40 mm white. **Figs 4P–R & 9.**

Specimens examined: Western Australia, Prince Regent River Reserve, 15°20'S, 124°56'E, Aug 1974, *Kenneally* 2168 (PERTH); Front Beach Road, Koolan Is, 16°09'S, 123°45'E, Jun 1984, *Vernon* 62 (PERTH); Tunnel Ck, Napier Range, 17°36'S, 125°08'E, Apr 1988, *Dunlop* 7756 & *Simon* (AD, BRI, CANB, DNA, MEL, NSW, PERTH); Geikie Gorge, 18°09'S, 125°41'E, Apr 1985, *Aplin*, *Cranfield* & *Wheeler* 269 (PERTH); Manning Gorge, Jun 1976, *Beaglehole* 52540 (PERTH); Road Crossing, Napier Range, May 1971, *Maconochie* 1185 (DNA, PERTH); 26 miles [43 km] N of "Nicholson", Jul 1949, *Perry* 2393 (BRI, CANB); "Ord River", Sep 1972, *Petheram* 462 (DNA). Northern Territory, Victoria River escarpment, 15°35'S, 131°06'E, Feb 1986, *Clark* 384 & *Wightman* (DNA); 3.5 km S of Keep River, 15°47'S, 129°05'E, Mar 1989, *Lucas* 7442 & *Medlicott* (DNA); Keep River N.P., 15°50'S, 129°06'E, Mar 1981, *Dunlop* 5833 (CANB, DNA, PERTH); Dennison Range, "Sturts Ck", Jul 1972, *Maconochie* 1770 (DNA); 50 km SE Billiluna, 19°45'S, 127°50'E, Nov 1980, *Done* 362 (DNA); Adam Bay, Oct 1867, [MEL 113687] (MEL).

Distribution and habitat: *C. puberulum* occurs in northern Australia in Western Australia and the Northern Territory (Map 2), where it grows on sandstone substrates in eucalypt woodland or on sandstone outcrops. Plants die back to the perennial rootstock during the dry season, then reshoot on the early storms of the wet season.

Phenology: Flowering from February to May, fruiting 2–3 months later.

Conservation status: Although rarely collected, this species should not be considered as rare or endangered.

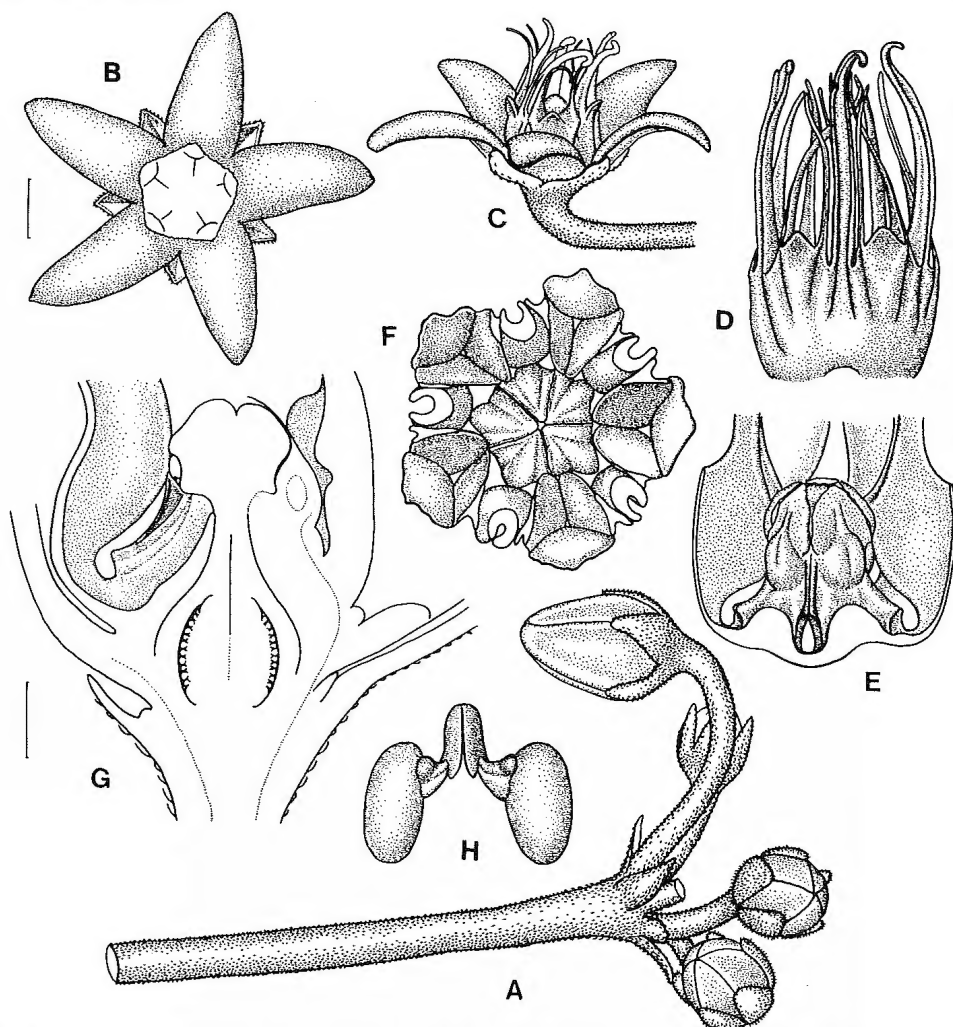


Fig. 9. *Cynanchum puberulum*: A. cyme with buds $\times 5$. B. face view of flower $\times 2.5$. C. side view of flower $\times 2.5$. D. side view of staminal column, obscuring the staminal column $\times 12.5$. E. side view of staminal column with staminal corona removed $\times 7$. F. face view of staminal column and style-head $\times 12$. G. cross-section of flower $\times 7$. H. pollinarium $\times 25$. All from spirit material of Dunlop 7756 & Simon. Del. P.V. Bruyns.

11. *Cynanchum pedunculatum* R. Br., Prodr. 463 (1810). *Cynoctonum pedunculatum* (R. Br.) Decne. in DC., Prodr. 8: 529 (1844); *Vincetoxicum pedunculatum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). **Type:** Northern Territory, Melville Bay (Arnhem North Bay), 14 February 1803, R. Brown (lecto (here designated): BM!, 2 sheets, photo at BRI!). Benth., Fl. austral. 4: 333 (1869); Bailey, Queensl. fl. 3: 1002 (1900); Williams, Native Pl. Queensl. 3: 198–199 (1988) [as *Marsdenia microlepis*]. *Cynanchum erubescens* R. Br., Prodr. 463 (1810); *Cynoctonum erubescens* (R. Br.) Decne. in DC., Prodr. 8: 529 (1844); *Vincetoxicum erubescens* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891); **synon. nov.** **Type:** Queensland, COOK DISTRICT: Endeavour River, 1770, Banks & Solander (lecto (here designated): BM!, 2 sheets, photo at BRI!). Sprengel, Syst. veg. 1: 851 (1820); Benth., Fl. austral. 4: 332 (1869); Bailey, Queensl. fl. 3: 1001 (1900); Britten, Illustr. Bot. Cook's Voyage 61, t. 201 (1901).

Herbaceous vine, latex white. Stems cylindrical, up to 2 mm diameter, with sparse indumentum; internodes up to 15 cm long. Leaves petiolate; lamina ovate to orbicular,

up to 6 cm long and 5 cm wide, discolourous; above green, glabrous, venation obscure; below pale green, venation obscure, glabrous or with sparse indumentum, tip acute; base strongly cordate-lobate; petiole grooved along top, up to 40 mm long and 0.5 mm wide; extrafloral nectaries 8–10 at lamina base. Cymes comprising 1–5 fascicles, up to 5 cm long; peduncle to 7 cm long, and 0.5–1 mm diameter, glabrous or with sparse to dense indumentum; bracts linear-lanceolate, 0.75–6 mm long, 0.25–1.5 mm wide, with scattered indumentum. Flower rotate, 3–7 mm long, 6–10 mm diameter; pedicels 6–12 mm long, 0.5–1 mm diameter with sparse indumentum. Sepals lanceolate to ovate, 2–4 mm long, 1–2.5 mm wide, with sparse indumentum; bases of sinuses with 1–8 glands. Corolla brown, cream, pink, pale purple; tube 1–1.5 mm long, 2–4 mm diameter; lobes lanceolate to ovate, reflexed at anthesis 2–8 mm long, 1.5–3 mm wide, glabrous. Staminal corona cream, 2–3.5 mm long, 1.5–4 mm diameter, comprising a tube with 15–20 irregularly shaped lobes, each lobe 0.7–0.9 mm long. Staminal column 2–4 mm long, 1.25–2.5 mm diameter; anther appendages ovate-crenulate, 0.75–1.5 mm long, 1–1.3 mm wide; slit between anther wings 0.75–1.5 mm long. Style-head conical-globose, 0.5–1 mm long, 1–2.5 mm diameter. Ovaries 0.8–2 mm long, 0.8–1 mm wide. Pollinarium 0.5–0.8 mm long, 0.6–1 mm wide; pollinia oblong, 0.25–0.47 mm long, 0.15–0.23 mm wide; corpusculum oblong, 0.27–0.4 mm long, 0.14–0.23 mm wide; caudicles 0.13–0.2 mm long, 0.1–0.17 mm wide. Follicles often paired, ovoid, 3.5–6.5 mm long, 1.7–3 cm wide, rugose or smooth. Seed ovate, 7–8 mm long, 4–5 mm wide; coma white, 25 mm long. **Figs 4A–C, L–M & 10.**

Selected specimens: Western Australia, near old Amax Camp Site, Mitchell Plateau, 14°49'S, 125°50'E, Mar 1987, *Dunlop* 6914 & *Gallen* (DNA, PERTH); Mitchell River, 14°50'S, 125°42'E, Feb 1980, *Dunlop* 5235 (BRI, DNA, PERTH); Crystal Ck track, c. 30 km NNW of Mining Camp, Mitchell Plateau, Jan 1982, *Kenneally* 7972 (PERTH); Kellys

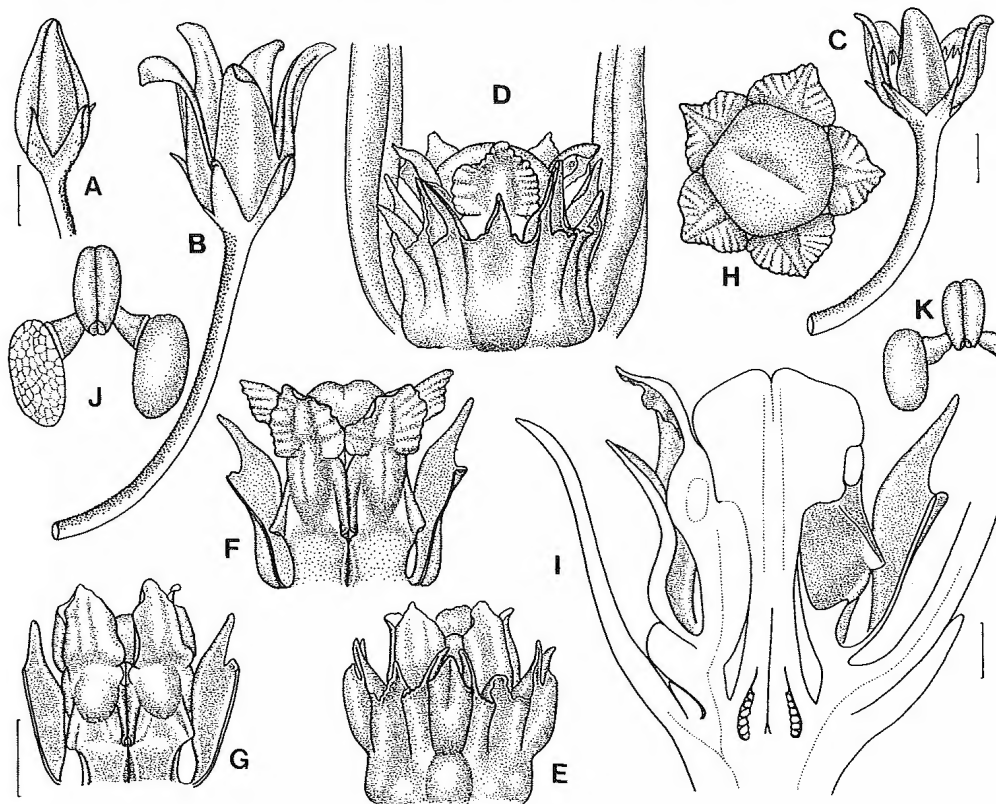


Fig. 10. *Cynanchum pedunculatum*: A, side view of bud $\times 6$. B, C, side views of flowers $\times 6$. D, E, side views of staminal coronas and staminal columns $\times 12.5$. F, G, side views of staminal columns with staminal coronas removed $\times 12.5$. H, face view of style-head and anther appendages $\times 12.5$. I, cross-section of flower $\times 12.5$. J, K, pollinarium $\times 84$. A, B, D, F, H, J from spirit material of King 18. Remainder from spirit material of Dunlop 6659. Del. P.V. Bruyns.

Knob, Kununurra, 15°46'S, 128°43'E, Nov 1981, *Dunlop* 5977 (DNA, MEL, PERTH); Keep River N.P., 15°46'S, 129°06'E, Apr 1982, *King* 102 (DNA); Junction of unnamed creek & Sale River, 30 km ESE of mouth, 16°02'S, 124°46'E, May 1986, *Kenneally* 9607 (PERTH); Gupungi road, S of Cable Beach, Broome, 17°55'S, 122°13'E, Mar 1987, *Kenneally* 9827 (DNA, PERTH); Durack Ranges, c. 62 km SE of "Bedford Downs", Jun 1975, *Symon* 10320 (AD, PERTH). Northern Territory. Darwin River Quarry, Jan 1969, *Byrnes* 1299 (DNA); behind Marlowe's Lagoon, Palmerston area, 12°29'S, 130°58'E, Dec 1987, *Tingey & Cox* [AQ 459650] (BRI); Ibangu Ck, S end of Ja Ja massif, 12°33'S, 132°55'E, Feb 1984, *Russell-Smith* 1118 (DNA); SE Mt Howship, Arnhem Land, 12°35'S, 133°10'E, Feb 1984, *Dunlop* 6659 (AD, DNA, MEL, NSW); 26 km past Mary River Crossing on Jabiru road, 12°53'S, 131°52'E, Dec 1989, *Forster* 6114 (BRI, DNA, MEL); Woolaning Saw Mill, 13°10'S, 130°40'E, Jan 1973, *Dunlop* 3141 (AD, BRI, CANB, DNA); Motor Car Ck, 13°32'S, 132°28'E, Jan 1982, *King* 18 (DNA); Angurugu, Groote Eylandt, 13°58'S, 136°27'E, Jan 1973, *Levitt* [DNA8164] (DNA); 0.25 miles [0.4 km] W of El Sharana, Jan 1973, *Martensz* AE607 (BRI, DNA); near Lake Dean, Jan 1963, *Muspratt* [DNA505] (DNA). Queensland. COOK DISTRICT: Rockingham Bay, *Dallachy* [AQ 216438] (BRI, MEL); Mt Saunders near Cooktown, Jul 1984, *Scarth-Johnson* 1569A (BRI). NORTH KENNEDY DISTRICT: Yaramulla Stn, Kilkani Cove, Apr 1980, *Williams* 80037 (BRI).

Distribution and habitat: *C. pedunculatum* is widely distributed and common in northern Western Australian and the Northern Territory, but has rarely been collected in Queensland (Map 3). This species is often associated with sandstone, limestone or granite and grows in open eucalypt forest and woodland on or near rock outcrops. The plants die back to the perennial rootstock during the dry season. When the early storms of the pre-wet season occur, the plants shoot, sending out long runners and flowering from these.

Phenology: Flowering from November to April, fruiting 2–3 months later.

Notes: *C. pedunculatum* is a very variable species and encompasses what was originally described by Robert Brown as *C. erubescens*. The type of *C. pedunculatum* has large flowers with corolla lobes longer than 6 mm and a well developed staminal corona longer than the staminal column (*King* 18 matches the type). The type of *C. erubescens* has small flowers with corolla lobes less than 4.5 mm long and a poorly developed staminal corona not exceeding the staminal column in length (*King* 102 matches the type). Small flowers tend to have small pollinaria and large flowers tend to have large pollinaria. To some extent it is possible to sort fertile material into two groups based on these few characters. However, the two entities so defined occur over the same geographic range, in the same habitat, and are indistinguishable in characters of the foliage and fruit. Furthermore, there are a number of collections that have staminal coronas of intermediate length (e.g. *Dunlop* 6659 and 3141) and there is considerable variation in size of the pollinarium and its components (Table 1). This degree of variation in flower size, staminal corona development and pollinaria occurs in other Australian species such as *C. brachystelmoides*. Species such as *C. tetrapterum* from Africa can have flowers of greatly different sizes and staminal corona development on the same plant at the same time (Forster, unpubl. data). Therefore the recognition of two taxa is unwarranted and all populations are referred to *C. pedunculatum*.

Conservation status: Not rare or endangered.

Table 1. Comparison of characters for four collections of *Cynanchum pedunculatum*

Character	Collection			
	<i>Dunlop</i> 6659	<i>Dunlop</i> 3141	<i>King</i> 102	<i>King</i> 18
flower length × diameter (mm)	4.5 × 8	5 × 10	4 × 6	7 × 7
lobe length × width (mm)	3.5 × 2	4–4.5 × 2	4 × 1.5–1.75	8 × 2.5
staminal corona length (mm) . .	2	2.5	1.5	2.5
no. lobes on corona	20	20	20	15
staminal column length (mm) . .	2	2	2	2.5
pollinarium length × width (mm)	0.70 × 0.70	0.55 × 0.80	0.80 × 1.00	0.50 × 0.70
pollinium length × width (mm)	0.37 × 0.19	0.37 × 0.20	0.30 × 0.18	0.47 × 0.23
corpusculum length × width (mm)	0.30 × 0.20	0.35 × 0.15	0.27 × 0.14	0.40 × 0.23

Excluded Species Names in *Cynanchum* and *Vincetoxicum*

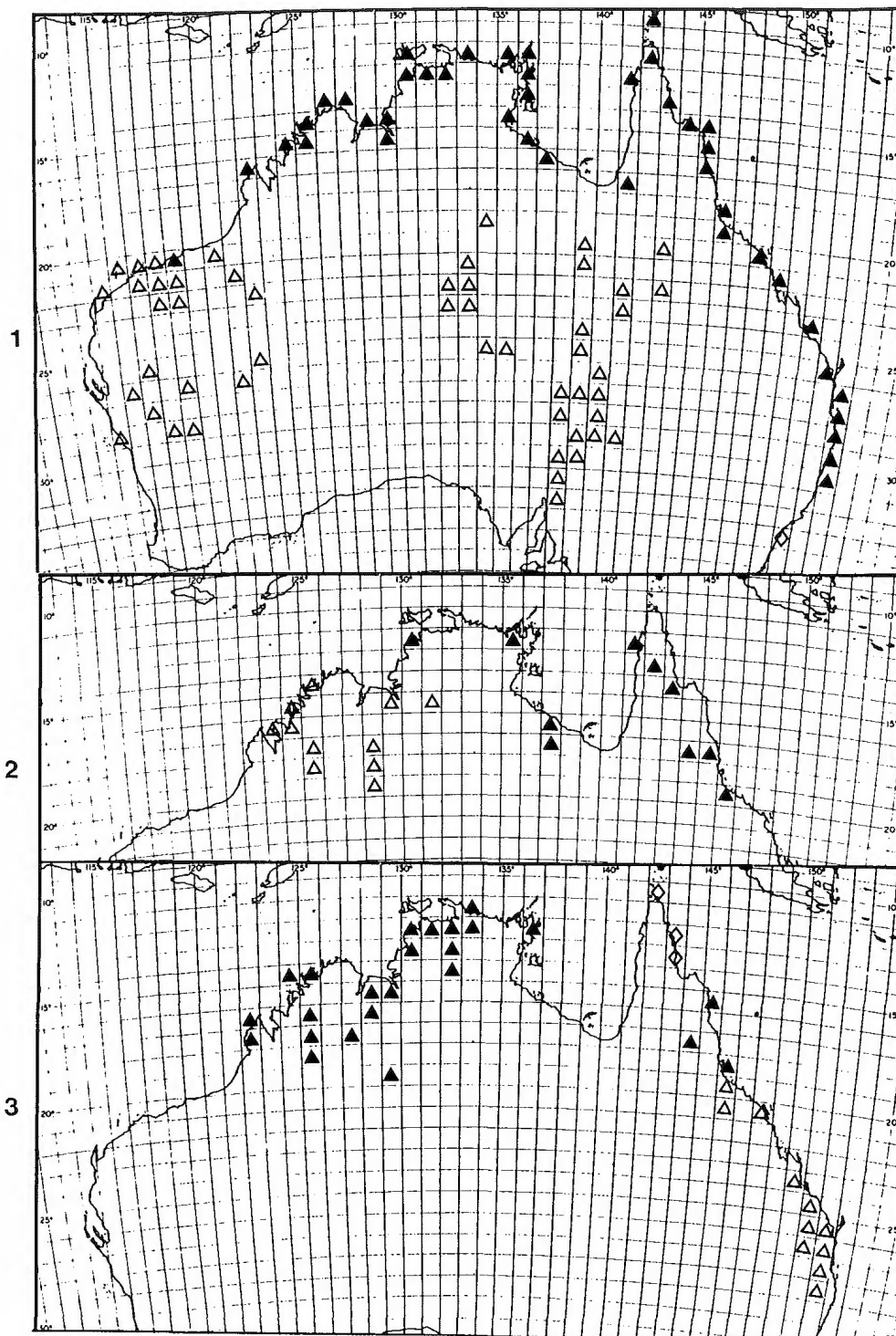
- Cynanchum neopommeranicum* Schltr., Bot. Jahrb. Syst. 50: 93 (1914), *nom. inval.*
- Cynanchum dichasiale* O. Schwarz, Fedde Repert. 24: 94 (1927). (= *Secamone elliptica* R. Br., *fide* Forster & Harold, Austrobaileya 3: 72 (1989)).
- Vincetoxicum woollsii* (Benth.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora woollsii* Benth.).
- Vincetoxicum grandiflorum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora grandiflora* R. Br.).
- Vincetoxicum paniculatum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 425 (1891). (= *Tylophora paniculata* R. Br.).
- Vincetoxicum erectum* (F. Muell. ex Benth.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora erecta* F. Muell. ex Benth.).
- Vincetoxicum polyanthum* O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora benthamii* Tsiang).
- Vincetoxicum calcaratum* (Benth.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Heterostemma acuminatum* Decne.).
- Vincetoxicum barbatum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora barbata* R. Br.).
- Vincetoxicum enerve* (F. Muell.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora biglandulosa* (Endl.) F. Muell.).
- Vincetoxicum flexuosum* (R. Br.) O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora flexuosa* R. Br.).
- Vincetoxicum benthamianum* O. Kuntze, Revis. gen. pl. 2: 424 (1891). (= *Tylophora erecta* F. Muell. ex Benth.).
- Vincetoxicum pachylepis* Bailey, Bot. Bull. 8: 79 (1893); *Cynanchum pachylepis* (Bailey) Domin, Biblioth. Bot. 89: 1085 (1928). (= *Marsdenia araujacea* F. Muell.).

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Maps 1-3. Distribution of *Cynanchum* spp.: 1. *C. floribundum* △; *C. carnosum* ▲; *C. elegans* ◇. 2. *C. puberulum* △; *C. leptolepis* ▲. 3. *C. bowmanii* △; *C. pedunculatum* ▲; *C. ovalifolium* ◇.

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TWO NEW SPECIES OF RED GUM (*EUCALYPTUS* L'HERIT., MYRTACEAE) FROM QUEENSLAND

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Summary

Two new Queensland Red Gum species (*Eucalyptus* series *Exsertae*) are described: *E. nudicaulis*, from the Mount Isa area and *E. terrica*, from south-eastern Queensland. A key to the members of Series *Exsertae* in Queensland and the Northern Territory is given.

Introduction

The Red Gum group (*Eucalyptus* series *Exsertae* Blakely (Chippendale 1988)), is perhaps the best known of all eucalypt groups, and includes *E. camaldulensis*, the most widespread species in the genus. The group reaches its greatest development in New South Wales, but is also well represented in Queensland.

Its species are characterised by the usually smooth, dappled bark, concolourous adult leaves, simple axillary inflorescences, double operculum (usually much longer than wide), fruits with strongly exserted valves, and (with the exception of *E. camaldulensis*) black angular seeds.

With the publication of this paper and others (Johnson & Hill 1990, in press), almost all the known red gum taxa of Queensland will have been described. The exception is *E. exserta* F. Muell. s. lat. which is highly variable and comprises at least two taxa. These will be treated in a future paper.

Taxonomy

Eucalyptus nudicaulis A. Bean sp. nov. affinis *E. gillennii* Ewart & L. Kerr a qua foliis adultis et juvenilibus multo angustioribus, operculis circa duplo longioribus quam latis differt. **Typus:** Queensland. BURKE DISTRICT: 25 km N of Mount Isa, November 1986, P.L. Harris 98 (BRI).

A mallee, 2–6 metres high. Bark smooth throughout, shiny, grey or silvery in colour, shedding in irregular flakes or sheets. Cotyledons bilobed. Leaves and stems glabrous at all stages. Seedling leaves opposite for about 8 pairs; narrow-lanceolate, grey-green, not glaucous, slightly discolourous, to 115 × 18 mm; petioles 4–10 mm long; stems more or less quadrangular; undersides of early seedling leaves purple. Juvenile leaves continuing narrow-lanceolate, grey-green, concolourous. Adult leaves narrow-lanceolate, dull, grey-green, concolourous, 12–19 × 1–1.8 cm; petioles terete, 15–30 mm long; petioles and leaf midribs yellow; lateral veins at about 45° to the midrib, terminating at an intra-marginal vein, finer reticulation incomplete, oil glands very numerous, of various sizes and colours. Inflorescence axillary, 7-flowered; peduncles terete, 7–13 mm long; pedicels 0–4 mm long; buds 12–15 × 6 mm, outer operculum shed early, inner operculum conical, pointed, about 11 × 6 mm; flowers white, stamens all fertile, outer stamens erect in bud, inner stamens irregularly flexed. Fruits ovoid to globular-truncate, 6–9 × 6–9 mm, disc broad, convex; valves strongly exserted, (3)4 or 5. Seeds black, angular, hilum terminal. **Fig 1.**

Specimens examined: Queensland. BURKE DISTRICT: Upper Stone Axe Creek, 25 km N of Mount Isa, Dec 1989, Harris 430 (BRI); west of Hilton Mine, c. 20 km N of Mount Isa, Jun 1989, Bean 1080 (BRI); headwaters of Stone Axe Creek, 25 km N of Mount Isa, May 1989, Crisp 8298 per P.L. Harris (BRI,CANB,CBG,MEL,NSW).

Distribution and habitat: *E. nudicaulis* is confined to the Mt Isa-Cloncurry area of north-western Queensland. It grows only on quartzite ridges, at altitudes between 400 and 520 metres. It is known from about six small populations, and it grows in rocky gullies or steep hillsides, in association with *E. leucophloia* Brooker, *E. capricornia* Carr & Carr, and *Triodia* spp. **Map 1.**

Flowering period: November – February.

Affinities: *E. nudicaulis* is most closely related to *E. gillennii* from the southern parts of the Northern Territory. However, it differs from this species in its narrow lanceolate juvenile leaves (compared to the ovate to orbicular juveniles of *E. gillennii*), the narrower adult leaves, and the longer, more conical operculum. The operculum of *E. gillennii* is scarcely longer than it is broad. Of the species indigenous in Queensland, *E. nudicaulis* is closest to *E. exserta* s. lat., but they are readily separated on bark characters.

Etymology: The specific epithet refers to the bark which is smooth throughout, in contrast to that of *E. exserta* s. lat., which is largely rough-barked.

Eucalyptus terrica A. Bean sp. nov. affinis *E. chloroclada* (Blakely) L. Johnson & K. Hill a qua cortice scabra, foliis alabastris fructibusque parvioribus, foliis juvenalibus multo angustioribus differt. **Typus:** 4.3 km from 'Terrica' Station, towards Gore, 12 September 1990, A.R. Bean 2254 & D.A. Kleinig (holo: BRI; iso: AD,CANB,MEL,NSW).

A small tree to 8 m high. Bark rough, brown and sub-fibrous on the trunk and largest branches; small and medium sized branches smooth-barked. Cotyledons elliptical, 3 × 5 mm; seedling leaves dull green, ovate to elliptical, to 66 × 18 mm, discolourous, opposite for about 5 pairs. Juvenile leaves narrow-lanceolate, green or bluish-green, discolourous, dull, 11–14 × 1–2.2 cm, petioles 5–7 mm long. Adult leaves narrow-lanceolate, grey-green, concolourous, 7.5–9.6 × 0.9–1.6 cm; venation regular, at about 45° to the midrib; oil dots numerous, several per areole; intramarginal vein present about 1 mm from leaf margin; petioles 10–14 mm long. Inflorescences axillary, 7-flowered; peduncles 4–6 mm long, pedicels 1–3 mm long; buds up to 8 × 3.5 mm, outer operculum shed early, inner operculum conical, up to 6 × 4 mm; stamens erect in bud, white. Fruits hemispherical to globular-truncate, 4–5 × 4–5 mm, disc flat or convex, valves strongly exserted, 3 or 4(5). **Fig 1.**

Specimens examined: Queensland. DARLING DOWNS DISTRICT: along Stanthorpe road, 10 km S of Warwick, Feb 1990, *Bean* 1362 (BRI,CANB); on road to 'Terrica', 22.3 km S of Gore, Nov 1989, *Bean* 1174 (BRI); 10 miles [16 km] NE of Inglewood, Feb 1969, *Stanton* s.n. [AQ 134415] (BRI); 1 km W of Coolmunda Dam, near Tobacco road, Oct 1988, *Grimshaw* C2 (BRI); Warwick-Pikedale road, 5 km SW of Rabbit Fence, Jun 1990, *Bean* 1649 (BRI); Warroo, Apr 1990, *Bean* 1476 (BRI,CANB) (seedling).

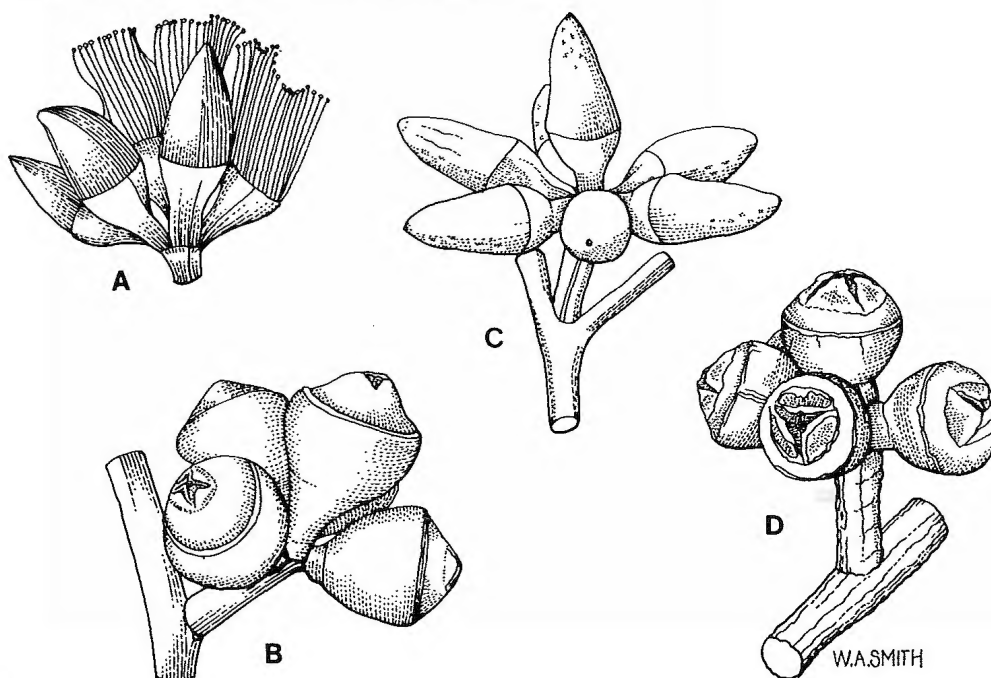


Fig. 1. *Eucalyptus nudicaulis*: A. Buds × 1.5. B. fruits × 1.5. *Eucalyptus terrica*: C. buds × 3. D. fruits × 3.

Material intermediate between *E. terrica* and *E. chloroclada*: 5 km E of 'Cattle Creek', on Cecil Plains-Moonie road, Feb 1988, *Bean* 725 (BRI); Inglewood S.F., north-west of Inglewood, Jun 1990, *Bean* 1661 (BRI).

Distribution and habitat: *E. terrica* has a limited distribution in the Warwick-Inglewood district of southern Queensland. The altitudinal range is 300–800 metres, with the highest altitudes being near Amiens. It grows on hilly country, on shallow light coloured loams. Associated eucalypts include *E. melliodora* Cunn. ex Schauer, *E. moluccana* Roxb. and *E. caleyi* Maiden. **Map 2.**

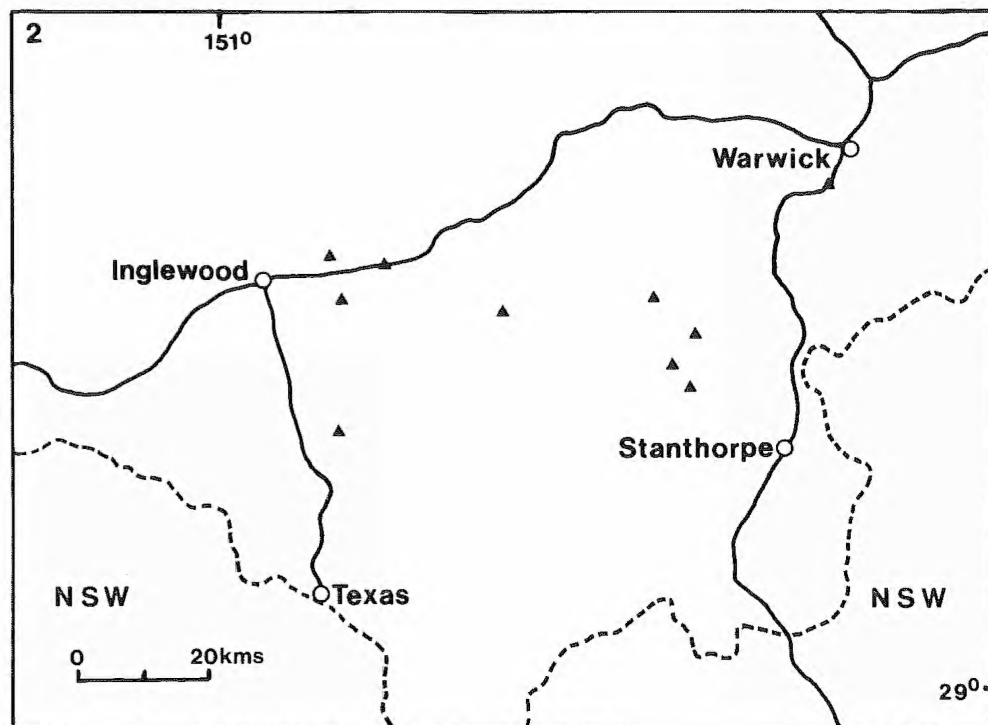
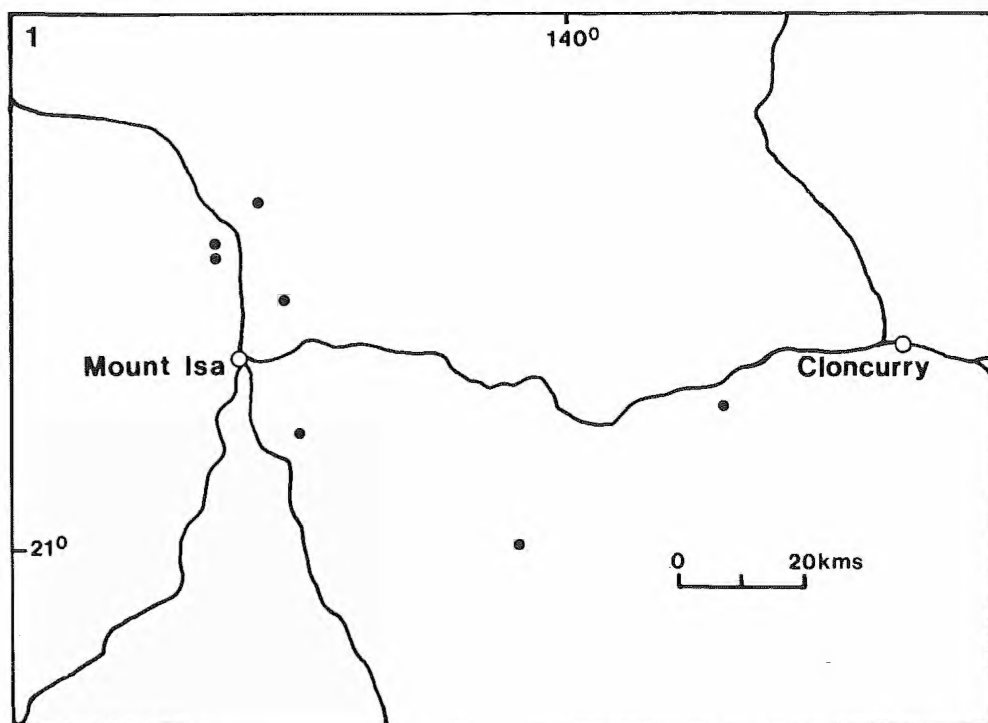
Flowering period: September – October

Notes: *E. terrica* is quite distinctive in the areas east of Inglewood, by virtue of the rough brown bark on the trunk and large branches, and very small leaves, buds and fruits. It intergrades with *E. chloroclada* in the Inglewood area; as one travels north and west, trees gradually become less rough-barked, the buds and fruits become larger, and the leaves, particularly the juvenile leaves, become larger and broader. Seedlings raised from the Cattle Creek area, NW of Inglewood (*Bean* 1477 (BRI,CANB)) display leaf dimensions intermediate between the two taxa. *E. terrica* is similar in appearance to *E. exserta* s. lat. These two taxa sometimes grow together, but when this occurs, there is no loss of identity for either.

Etymology: The specific epithet refers to the name of the station near where the type was collected, which is near the middle of the distributional range of the species.

Key to the Red Gums (*Eucalyptus* series *Exsertae*) of Queensland and Northern Territory

1. Trees, bark rough at least on majority of trunk 2
 Trees or mallees, bark smooth and deciduous, or with a short stocking
 of rough bark 4
2. Rough bark on trunk only, trees preferring swampy sites, leaves green,
 fruits 7–10 mm long *E. brassiana*
 Rough bark extending at least to larger limbs, trees of dry hilly sites,
 leaves grey-green, fruits 4–8 mm long 3
3. Rough bark on trunk and largest branches; fruits 4–5 mm long; disc flat
 to slightly convex; juvenile leaves narrow-lanceolate *E. terrica*
 Rough bark extending almost throughout; fruits 5–8 mm long; disc
 steeply convex; juvenile leaves linear to lanceolate *E. exserta* s. lat.
4. Bark dull, granular; base of fruiting valves below rim 5
 Bark shiny, not granular; base of fruiting valves at or above rim level 8
5. Adult leaves narrow-lanceolate; fruits 5–6 × 5–6 mm 6
 Adult leaves broad-lanceolate; fruits 6–9 × 7–9 mm 7
6. Juvenile leaves linear; trees of coastal areas *E. seeana*
 Juvenile leaves broad-lanceolate; non-coastal trees, often near Great
 Dividing Range *E. interstans*
7. Buds not glaucous; operculum conical to horn-shaped; coastal trees;
 leaves acuminate *E. bancroftii*
 Buds glaucous; operculum ovoid; inland trees; leaves obtuse or acuminate
 *E. prava*
8. Buds and adult leaves markedly glaucous *E. dealbata*
 Buds and adult leaves not glaucous 9
9. Mallees or small trees of skeletal rocky slopes 10
 Medium to large trees of various habitats, but not on rocky slopes 12



Maps 1 & 2. Distribution of *Eucalyptus* spp. 1. *E. nudicaulis*. 2. *E. terrica*.

10. Inflorescences 9–13-flowered, fruits 4–5 mm long **E. kabiana**
 Inflorescences 7-flowered, fruits 6–10 mm long 11
11. Operculum length/breadth ratio 1.5–2, juvenile leaves narrowly lanceolate **E. nudicaulis**
 Operculum length/breadth ratio 1–1.5, juvenile leaves ovate to orbicular **E. gillenii**
12. Operculum length/breadth ratio <1.6 13
 Operculum length/breadth ratio >1.6 14
13. Trees of watercourses; disc of fruit strongly convex; valves curved; seeds yellow **E. camaldulensis**
 Trees of sandy cypress-pine flats; disc of fruit flat or slightly convex; valves straight; seeds black **E. chloroclada**
14. Trees of frosty flats; juvenile leaves orbicular and green; buds and fruits often sessile **E. amplifolia**
 Trees of hillsides or watercourses; juvenile leaves ovate, bluish; buds and fruits not sessile 15
15. Umbels 7–11-flowered; operculum conical, straight-sided; flowering Dec–Feb; adult leaves bluish-green **E. blakelyi**
 Umbels 7-flowered; operculum horn-shaped, expanded at base; flowering Apr–Sept; adult leaves green **E. tereticornis**

Acknowledgements

I am grateful to Peter Harris of Mt Isa who drew my attention to *E. nudicaulis* and provided much information about it. I would also like to thank Will Smith for the illustrations and Les Pedley for the Latin diagnoses.

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STUDIES IN *DIANELLA* LAM. EX JUSS. (PHORMIACEAE) 2

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Summary

Dianella fruticans, from south central Queensland, is described as new and its relationship to other species of the Phormiaceae is discussed. The legitimacy of *Dianella odorata* Blume is reviewed. It is concluded this is a legitimate name. *Dianella brevipedunculata* R. Henderson, confined to Queensland, is recorded for the Maranoa pastoral district at a site more than 350 km north-west of its previously known most westerly occurrence, and from the Port Curtis pastoral district at a site in the tropics at least 100 km north-west of its previously known most northerly occurrence.

Introduction

This is the second of my papers dealing with taxonomy and nomenclature in *Dianella* Lam. ex Juss., included variously in Phormiaceae (Henderson & Clifford 1984) or, in the system of Cronquist (1981), in Liliaceae (Henderson 1987). Since the first paper appeared (Henderson 1988), a new species of *Dianella* has been found in Queensland and this needs formal naming. The legitimacy of the name *Dianella odorata* Blume, presently accepted for a taxon in northern Australia, needs consideration as Fosberg and Sachet (1987) listed that name as illegitimate. A major and a minor extension to the distributional range of *Dianella brevipedunculata* R. Henderson have been noted and are worth recording.

1. New *Dianella* species from Queensland

A very unusual specimen, apparently of a *Dianella* species, was collected from the Mount Moffatt section of the Carnarvon National Park in south central Queensland by Mr Barry Jahnke in September 1986. The material was not complete, being only a twig with a young inflorescence with immature flower buds. Basal portions of plants, including rhizomes and roots as well as flowers and fruits, are necessary for positive identification of *Dianella* material. Even so, Jahnke's specimen suggested that, if it belonged to that genus, it represented a completely new species. A trip to examine the plants *in situ* in late 1987 yielded only sterile specimens, and transplants to Brisbane languished and subsequently died. In December 1987, a sterile specimen of the same plant, from the difficult-to-access Ka Ka Mundi section of the park, was submitted to the Queensland Herbarium for identification. The Mount Moffatt section was ravaged by bushfires in late 1988 ruling out a visit to the site that year. In December 1989, a colleague, Ms Megan Thomas, collected scant flowering material of it from there which all but proved the plant belonged to *Dianella*. A visit to the park in February 1990 produced ripe fruit which confirmed that this plant indeed belongs to an entirely new species of that genus.

***Dianella fruticans* R. Henderson sp. nov.** ab speciebus omnibus aliis *Dianellae* Lam. ex Juss. perspicue propria sed forsan *D. incollatae* R. Henderson propinquissime affinis. Caulibus aëribus 0.5–3 m longis, surculis extra-vaginalibus systema extensum ramorum facientibus, foliis brevibus prope basin equitantibus, griseo-viridibus, apice parum recurvis (non cucullatis) et vagina foliorum proximale perfecte apertis, floribus viridi-caeruleis in inflorescentiis contractis decurvis ultra folia apicalia caulium vel ramorum breviter extensis portatis distinguitur. **Typus:** Queensland. MARANOA DISTRICT: NW of Marlong Plain on a sandstone ridge of the Chesterton Range, Mt Moffatt Section, Carnarvon National Park, 23 November 1990, R.J.F. Henderson H3503 & P. Robins (holo: BRI(2 sheets); iso: CANB, K, NSW, distribuendi).

Plants caespitose, perennial, to c. 2 m high; tufts open, to c. 50 cm across at base; roots fibrous-fleshy, some with fleshy tubers to 20 cm long and 2.5 cm across 15–25 cm from the rhizome; aerial stems ascending to decumbent, 0.3–3 m long, leafy throughout, ultimately bare for most of their length due to leaf drop. Leaves distichous, evenly dispersed along aerial stems, 5–20 cm long, grey green, glaucous; sheaths equitant, slightly ridged abaxially, slightly occluded distally where $\pm$ V-shaped transversely, $\pm$ indistin-

guishable from blade, minutely auriculate proximally and not forming any tube round the stem; blades 0.6–1.2 cm across, complicate or incurving (inrolling when dry), ultimately acute at the outwardly curving tip, smooth or minutely and irregularly sparsely scabrid on margins distally and midrib abaxially; veins distinct, slightly raised on upper and lower surfaces. Inflorescence contracted, open, irregular in outline, interrupted, arcuately curving, $\pm$ within leaf canopy; bracts from c. 3.5 cm (lower) to c. 2 mm (upper) long, sheathing at base; bostryces condensed, 1(?)–3-flowered; pedicels slightly arcuate or straight, 0.5–10 mm long, rounded throughout. Perianth segments narrowly ovate to elliptic, pale bluish yellowish green; sepals obtuse, cucullate, 7–8 mm long, 5-nerved; petals obtuse-emarginate, 6.5–7 mm long, 5-nerved. Stamen filaments 2.5–3 mm long, kinked; struma globular, yellow, c. 1 mm long; anthers pale yellow, 3–3.5 mm long, tapered upwards. Ovary depressed globular, c. 1.8 mm across; ovules 6–8 per locule; style c. 4.5 mm long, with stigmatic papillae on the truncate apex. Berry depressed globular but obscurely trilobed at maturity, to c. 1.2 cm wide and 1 cm long, purplish blue; seed $4.3\text{--}4.7 \times 3\text{--}3.6 \times 2\text{--}2.5$ mm; testa smooth, black, glossy; hilum punctiform. **Fig. 1.**

Specimens examined (all BRI): Queensland, LEICHHARDT DISTRICT: Mt Moffatt Section, Carnarvon National Park, $24^{\circ}54'S$ $147^{\circ}59'E$, along walk to Kenniff's Cave from car-park (c. 80 km SW of Rolleston), Oct 1987, Henderson H3089; ditto, Dec 1989, Thomas & Gees [AQ 459253]; ditto, Feb 1990, Henderson H3340 & Franks. WARREGO DISTRICT: Ka Ka Mundi section of Carnarvon National Park, $24^{\circ}4'S$ $147^{\circ}2'E$, Dec 1987, Kelly DK1. MARANO DISTRICT: Mt Moffatt section of Carnarvon National Park, on top of scarp to NW of Marlong Plain, $24^{\circ}55'S$ $147^{\circ}56'E$, Sep 1986, Jahnke [AQ 367491]; Mt Moffatt Section, Carnarvon National Park, NW of upper Marlong Plain (c. 90 km SW of Rolleston and 14 km N of park headquarters), Feb 1990, Henderson H3342 & Franks; ditto, Nov 1990, Henderson H3503 & Robins (TYPE).

Distribution and habitat: *D. fruticans* is known only from the Ka Ka Mundi and Mount Moffatt sections of the Carnarvon National Park in south central Queensland (**Map 1**). In localities seen, the plant occurs sparsely in rocky sandstone outcrops in open eucalypt forest on the crest or upper slopes of sandstone ridges. One site faces north east and is on the Great Dividing Range, the other two face south east and are on the Chesterton Range not far from its junction with the Great Dividing Range. The roots seem few and thickened and are wedged well down in sand and organic material in cracks in the rock. At no site are there extensive populations of the plant.

Phenology: The plant flowers in spring to early summer and fruits in mid to late summer.

Relationships: *D. fruticans* is clearly distinct from all other species of *Dianella* and at first sight may be considered to belong to a distinct genus, so different is its vegetative appearance. However, its stamens with a squat filament struma and a straight anther remaining straight after dehiscence, and blue fleshy berries with shiny black seeds with punctiform hilum clearly show it belongs in *Dianella*.

In habit it is similar to *Rhuacophila javanica* Blume from Indonesia to New Caledonia and Fiji, and has lower bracts similar to those of that species, but the floral attributes mentioned above exclude it from *Rhuacophila*. It also shows similarity with *Stypandra glauca* R. Br. from Australia in habit, but again the above attributes exclude it from *Stypandra*. Within *Dianella* it is apparently, because of the little-occluded leaf sheaths, most closely related to *D. incollata* R. Henderson from sandstone areas in far north Queensland. It is distinguishable from that by its longer aerial stems which develop an extensive branching system from primary, secondary and tertiary extra-vaginal shoots in upper regions of the stems and branches. Also, it has shorter, equitant (rather than distinctly patent), grey-green, inrolling leaf blades and pale green-blue flowers in contracted, decurving inflorescences extending only a little beyond the apical leaves on each stem or branch (rather than an open and exerted inflorescence).

In its stem system it shows similarities to *D. bambusifolia* H. Hallier, *D. caerulea* var. *protensa* R. Henderson, *D. caerulea* var. *assera* R. Henderson, *D. pavopennacea* R. Henderson var. *pavopennacea* and *D. pavopennacea* var. *major* R. Henderson but these are clearly distinct in attributes of leaves and/or the inflorescence, and none of them has large tubers produced on only some of their roots.

Notes: In my key to Australian species of *Dianella* given in Flora of Australia (Henderson 1987), *D. fruticans* keys to couplet 10/10: Leads 10/10: and 11/11: should be modified as follows.



Fig. 1. *Dianella fruticans*: A. habit of plants $\times c. 0.03$. B. branch apex with young inflorescence $\times 0.3$. C. branch apex with inflorescence bearing buds and fruits $\times 0.67$. D. transverse section of leaf lamina $\times 2$. E. transverse section of leaf in zone of occlusion $\times 2$. F. flower with a petal and stamen removed $\times 4$. A, Henderson H3342 & Franks; B, Jahnke [AQ 367491]; C,D, Henderson H3503 & Robins.

- 10 Margins of leaf lamina smooth or with occasional minute pricklets particularly distally
- 10A Leaf lamina venation parallel; intervein areas opaque; pedicels $\pm$ straight, divaricate, 0.5–10 mm long; petals 5-nerved; lateral faces of seed smooth (southern central Qld) **D. fruticans**
- 10A: Leaf lamina venation $\pm$ scalariform; intervein areas translucent
- 11 Pedicels arching or spreading, 12–25 mm long; petals 5-nerved; lateral faces of seed areolate but smooth and evenly convex (northern Qld & northern N.T.) **D. odorata**
- 11: Pedicels $\pm$ straight, erect or ascending, 1.5–10 mm long; petals 3-nerved; lateral faces of seed alveolate and irregularly ridged (northern Qld) **D. bambusifolia**
- 10: Margins of leaf lamina regularly serrulate-scabrous virtually throughout; venation parallel or scalariform; intervein areas opaque or translucent
- 12 Leaf lamina $\pm$ coriaceous; ... etc.

Conservation status: From its present-known distribution and occurrence in a declared National Park, a conservation code of 2RCt (see Briggs & Leigh 1988) is appropriate.

Etymology: The specific epithet *fruticans*, Latin for 'growing into a shrub-like plant', refers to the habit of the plant throughout its life span.

2. In defence of *Dianella odorata*

I have used the name *Dianella odorata* Blume for a taxon occurring in northern and north-eastern Australia extending from Bathurst Island, Northern Territory to Hinchinbrook Island, Queensland and including coastal areas on the mainland between (Henderson 1987). This taxon also occurs in Indonesia. Fosberg and Sachet (1987) in describing *Dianella saffordiana* from Guam included in the synonymy "*Dianella odorata* sensu Schlittler, 1957 non Bl. 1827 (nom. – superfl. illegit.)" and in discussion about a specimen in US (*C.B. Robinson* 505) say that it is referable to "*D. odorata* Bl. (nom. illegit.)". Incidentally, I examined *C.B. Robinson* 505 on loan from US (Sheet 654815) several years ago (c. 1976) and considered it belongs with *D. odorata*, as Drs Fosberg and Sachet have suggested.

In correspondence, Dr Fosberg explained his opinion on the legitimacy of Blume's name as follows.

"My point about *Dianella odorata* Bl. is that Blume's citation of *Dracaena ensifolia* Lour., a somewhat indirect reference to *Dracaena ensifolia* L., in synonymy makes *Dianella odorata* Bl. superfluous and therefore illegitimate. I think there is little doubt that Loureiro was merely using the Linnean name, rather than creating a new species."

When describing *Dianella odorata* as new, Blume (1827) based his description on plants growing in gardens in what is now Indonesia and specifically on a specimen from "Archipel. indic.", collector unknown, now housed in the Leiden herbarium (Herb. Lugd. Bat. 908.106 738). In addition to a description, his protologue included a diagnosis distinguishing the plant from *Dianella revoluta* R. Br., and two references as follows.

"*Dracaena ensifolia*. Lour. Cochinch. 1. p. 243. 2.
Gladiolus odoratus. Rumph. amb. 5. p. 145, t.73."

(As it happens, the page and species number references given here for Loureiro's Flora by Blume relate to the second edition edited by C.L. Willdenow, published in 1793 (Stafleu & Cowan 1981). Loureiro dealt with *Dracaena ensifolia* on page 197 of the first edition of his Flora (1790). Blume apparently had no access to this.)

I agree with Dr Fosberg on his last point. There can be no doubt that Loureiro, in 1790, was dealing with a taxon (or taxa) from field localities in Cochinchina (Indo-China) for which he used the name *Dracaena ensifolia*, following Linnaeus (1767), and not describing a species anew as *Dracaena ensifolia*. Merrill (1935) came to this conclusion too in his commentary on Loureiro's Flora. Loureiro considered his plants conspecific with Linnaeus's and also with plants Rumphius (1747) called *Gladiolus odoratus indicus*, probably because Linnaeus cited Rumphius's plate in his protologue of *Dracaena ensifolia*. Merrill explained in detail Loureiro's often misinterpretation (more than 56% overall) of Linnaeus's taxa, and his basis for interpreting those taxa in relation to the plants dealt with in Flora Cochinchinensis. In the case of *Dracaena ensifolia* though, Merrill agreed with Loureiro's application of Linnaeus's name, and accepted *Dianella ensifolia* (L.) DC. for Loureiro's Indo-China plants. He noted, however, they are not conspecific with Rumphius's Amboina ones.

"*Dracaena ensifolia* Loureiro", or more correctly *Dracaena ensifolia* sensu Loureiro, is therefore a taxonomic grouping which may or may not correspond to the taxon Linnaeus called *Dracaena ensifolia*. Linnaeus seemingly did not see the plants Loureiro described and it is doubtful that Loureiro saw the specimens in Linnaeus's herbarium which formed the main basis of his protologue description (Merrill 1917, p. 136). As Merrill (1935) pointed out, Loureiro's concept of the species covered plants of (at least) two species. Linnaeus's concept of *Dracaena ensifolia* also encompassed plants of more than one species (Henderson 1977, 1987) one of which was represented by Rumphius's plate. Article 48 of the International Code of Botanical Nomenclature (ICBN) (Greuter *et al.* 1988), dealing with an author using an existing name but excluding its type from the taxon he applied it to, thus surely cannot apply. I consider, therefore, "*Dracaena ensifolia* Loureiro", being a taxonomic grouping, is of no nomenclatural significance.

For Article 63 of the ICBN to be invoked to render *Dianella odorata* Blume superfluous and illegitimate, Blume would have to have "definitely included" within his circumscription of that species "the holotype or *all* syntypes or the *previously designated* lectotype" (my emphasis) of an earlier name that ought to have been adopted, or whose epithet ought to have been adopted, under the rules. Inclusion of a type is understood to mean (ICBN Art. 63.2)

- a. the citation of the type specimen,
- b. citation of an illustration of the type specimen,
- c. citation of the type of a name, or
- d. citation of the name itself unless the type is at the same time excluded either explicitly or by implication.

In publishing the name *Dianella odorata*, Blume cited no specimens of any kind so criteria a. and c. do not apply. To argue that he indirectly cited type specimens by citing the references he did, seems an obscure interpretation of the word 'citation' and is not convincing. Rumphius's table 73 in volume 5 of his Herbarium Amboinense was one of the syntypes (now a lectoparatype) of the name *Dracaena ensifolia* L., so criterion b. can be taken to be applicable to this element. However, all other syntype material would also have to have been definitely included for citation of this table to be relevant for no lectotype had been chosen for the name by 1827 (Art. 63.1). Blume did not cite *Dracaena ensifolia* L. (the name itself) in his protologue so criterion d. does not apply either. It is acknowledged that Linnaeus (L.) is not part of the name as defined by ICBN Article 23, but citation of the author of a name is mandatory for the following requirements concerning the type in criterion d. to be relevant. The only part of Article 63.2 dealing with implication relates to the exclusion of 'the type' (? holotype) of a name, which in the case of *Dracaena ensifolia* L. would probably not apply anyway as that has no holotype. Inclusion of type material depends on direct citation of it.

Blume clearly was fully aware of Linnaeus's names for under "*Dianella*, Lam." on page 12 of his Enumeratio, he included "*Dracaenae* sp. Linn.". In addition, the specimen at L considered to be and marked as (holo)type of *Dianella odorata* Blume (by both an unknown hand (presumably not Blume's) and J. Schlittler in June 1947) was originally determined "*Dracaena ensifolia*, Linn.". The original label is then annotated, presumably in Blume's hand, "*Dianella odorata* Bl./ media intr. D. divaricatus et

D. rarum, a priori differt panicula simplici ramisque strictis. a *D. rara* autem foliis lineari-ensiformibus haud linearibus/fig. Rumph. optima".

Blume chose to ignore Linnaeus's epithet and was guided by Rumphius's plate and polynomial *Gladiolus odoratus indicus* in choosing the epithet "odorata". There is no evidence that Blume saw that part of Linnaeus's "original material" subsequently chosen as lectotype of his name, a specimen in Linnaeus's herbarium in LINN. From the foregoing then, it is clear he cannot be considered to have definitely included all syntypes of Linnaeus's name within his circumscription of *Dianella odorata*.

In summary then, I contend that Blume's name *Dianella odorata* is legitimate for the following reasons:

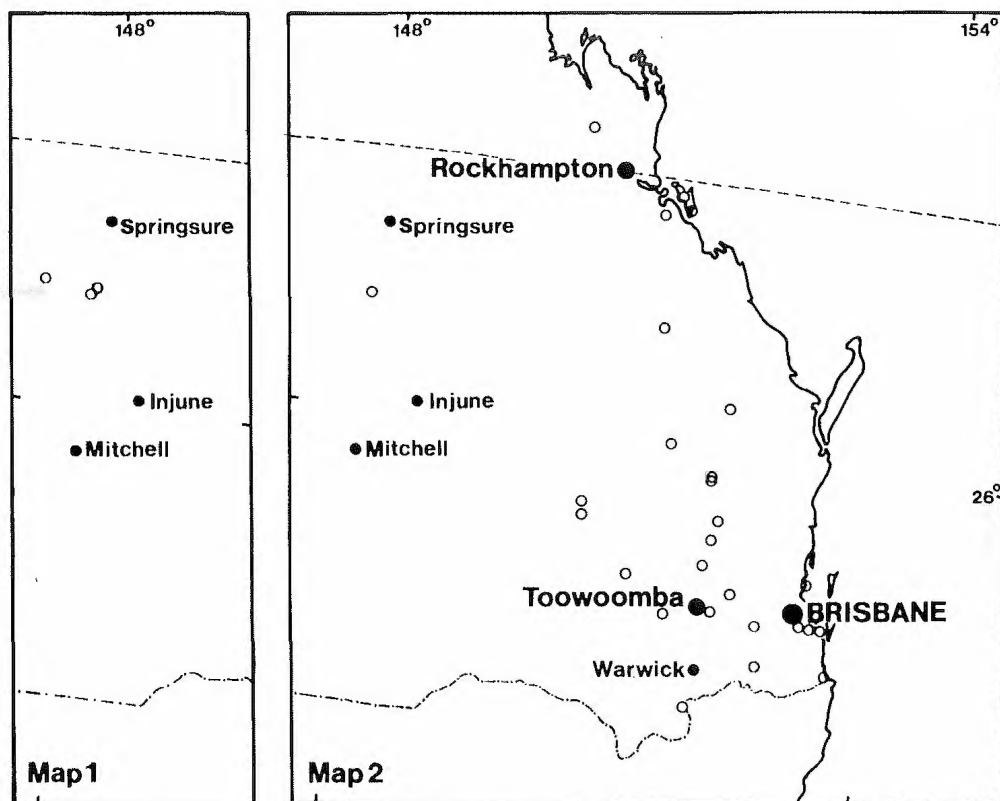
1. He was describing a new taxon distinct from that covered by the name *Dracaena ensifolia* L. (as currently lectotypified), based on a specimen (or specimens) from "Indiae orientalis" (Indonesia) at his disposal (Blume 1827, Praef.). He considered these conspecific with Rumphius's plants from Amboina (also in the area covered by his Enumeratio).
2. Though he thought his plants were conspecific with the plants Loureiro included under *Dracaena ensifolia* (based on the latter's incidental citation of Rumphius's plate), he did not realise Loureiro's use of that name covered at least two different species.
3. Had he considered his plants conspecific with Linnaeus's he would have used the latter's name, as he did two pages earlier in his Enumeratio in accepting *Dracaena terminalis* L. for other local (Indonesian) plants, or made the necessary transfer of the epithet to *Dianella* for them.
4. He did not publish a superfluous name for his (Indonesian) plants by mentioning Willdenow's re-publication of Loureiro's application of a previously published name to Indo-China plants and his misapplication of that name to Rumphius's (Indonesian) plants.

Recognition of *Dianella odorata* as legitimate, I believe, best serves the original author's intent, as evidenced by his published opinion, and is in line with the opinion of many subsequent authors (Merrill 1917, pp.136 & 137). We can, therefore, continue to use the name for some of our Australian *Dianella* plants.

3. Extensions to recorded distributional range of *Dianella brevipedunculata*

In undertaking field trips to collect material of *Dianella fruticans* in February and November 1990, I found extensive stands of *Dianella brevipedunculata* R. Henderson that greatly extend the known distributional range of the species. The first is on sandy alluvial flats beside tributaries of Marlong Creek, north-west of Marlong Plains, and below sandstone ridges of the Chesterton Range in the Mount Moffatt section of the Carnarvon National Park. The vegetation of this site is open eucalypt forest with a ground cover of mostly grasses. The other occurrence of the species is along a small tributary of the Fitzroy River near Canoona, about 50 km north-west of Rockhampton. At that site, the vegetation is eucalypt forest with predominantly grassy ground cover abutting fringing forest of mainly *Casuarina cunninghamiana* Miq. and *Callistemon viminalis* (Sol. ex Gaertner) G. Don ex Loudon, all growing on serpentinite-derived soils.

D. brevipedunculata is a most adaptable and easily identifiable species which grows in forest habitats from beside the sea east of Brisbane, to areas at c. 900 m altitude in the Bunya Mountains (south-east Queensland), from near Marlborough, north-west of Rockhampton, to the Queensland/New South Wales border and westward to the foot of the Chesterton Range, north-west of Roma. The newly established western record extends the species' known distribution some 250 km westward of its previously known western limit and is approximately 360 km from the nearest previously known population of it. The newly established northern occurrence extends the species' limit into the tropics, to a site at least 100 km north-west of the previously known most northerly population of it. Map 2*.



Maps 1 & 2. Distribution of *Dianella* spp.: 1. *D. fruticans*. 2. *D. brevipedunculata*.

To vouch for these records, relevant specimens (*Henderson* H3507 & *Robins* for the westerly occurrence, *Henderson* H3491 & *Robins* for the northerly one) have been lodged in BRI.

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My thanks to Megan Thomas and Barry Jahnke for bringing *D. fruticans* to my attention, observing plants in the field when I could not, and giving specific instructions for finding them in their obscure habitats. Andrew Franks and Paul Robins helped with field work, and Will Smith prepared the maps and illustrations. This assistance is gratefully acknowledged. The Queensland National Parks and Wildlife Service kindly granted me a permit to collect *Dianella* material in Carnarvon National Park. I thank Dr Raymond Fosberg for his correspondence on the legitimacy of *Dianella odorata*. Les Pedley made useful suggestions for clarifying my text on this topic and these have been incorporated.

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*Note in proof: A further population of *D. brevipedunculata* has been found E of Springsure, the first BRI record of the species in Leichhardt Pastoral District. Details of the voucher are E slopes of Expedition Ra., c. 45km E of Rolleston, Jun 1991, *Henderson* H3512 & *Thompson* (BRI).

NOTES ON *MACROZAMIA* MIQ. (ZAMIACEAE) IN QUEENSLAND WITH THE DESCRIPTION OF TWO NEW SPECIES IN SECTION *PARAZAMIA* (MIQ.) MIQ.

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Summary

Macrozamia fearnsidei and *M. lomandroides*, both members of section *Parazamia* (Miq.) Miq. from central Queensland, are described as new, the new combination *M. plurinervia* is made for *M. pauli-guilielmi* subsp. *plurinervia* L. Johnson and *M. mountperriensis* Bailey is recognised as specifically distinct from *M. miquelii* (F. Muell.) A. DC. A key to the species of *Macrozamia* in Queensland is given.

Introduction

The most recent systematic treatment of *Macrozamia* Miq. is that of Johnson (1959) who recognised 14 species and gave a key to identify them. This work provided the basis for flora treatments (Johnson 1961; Stanley & Ross 1989) and was a valuable foundation for biological and genetic studies (Ornduff 1986, 1990; Ellstrand, Ornduff & Clegg 1990). Taxonomic problems have been identified in the genus and some of these have been investigated by me over the last three years. This paper presents the results of studies into taxa in Queensland. A key is presented to the Queensland species of *Macrozamia*.

Taxonomy

***Macrozamia fearnsidei* D. Jones sp. nov.** affinis *M. pauli-guilielmi* W. Hill et F. Muell. habitu multo robustiore pluribus frondibus (usque 20) coronata, pinnis concavis multo longioribus latoribus nitentibus viridibus supra, strobilis magnis eorum sporophyllis plurimis spina apicali vestigiali praeditis differt. **Typus:** Queensland. LEICHHARDT DISTRICT: Wallaroo Station, c. 64 km north of Injune, 26 August 1990, D.L. Jones 6307 & B.E. Jones (holo: CBG; iso: BRI,CBG,NSW).

Caudex more or less ovoid, 15–35 cm diameter, subterranean. Fronds 70–140 cm long on mature plants, dark green and lustrous, 5–20 in an erect very bushy crown, rarely nearly prostrate; petiole (excluding the woolly expanded base) 15–40 cm long, c. 15 mm across at the top of the expanded base, dark green, dull, flat or slightly concave above, strongly convex below; rhachis spirally twisted 1–5 times, 8–10 mm across at the lowest pinnae, the cross-section similar to that of the petiole, dull green, with irregular cream markings between the bases of the distal pinnae but not in a continuous band. Pinnae linear, arising at a steep angle to the rhachis, obliquely erect to arcuate before drooping in the distal third, 20–60 cm × 6–11 mm, hypostomatic, dark green and shiny above, paler with 9–12 prominent raised veins beneath, strongly concave in cross-section, spirally twisted 1–4 times, apex acuminate, slightly pungent, callous base cream to pale yellow, 55–120 per frond, arranged more or less in two ranks but not always in opposite pairs, crowded, the longest pinnae found towards the middle of the frond, lower pinnae hardly reduced. Male cones more or less cylindrical, 15–27 cm × 4.5–6.5 cm, usually curved with age; peduncle 18–30 cm × 1.2–1.8 cm, circular to elliptical in cross-section; sporophylls cuneate to cordate, 1.6–2.2 cm × 1.5–2 cm, those in the proximal two-thirds of the cone with vestigial spines, distal ones with stiff, pointed spines to 1.3 cm long. Female cones more or less ovoid, 12–18 cm × 8–10 cm, erect; peduncle 18–27 cm × 1.5–2.2 cm, elliptical in cross-section, furrowed; sporophylls with stipe 1–1.5 cm long, transversely ovate to reniform, 1.7–2.8 cm × 1–1.5 cm, with a prominent depression just below the apical spine, spines increasing in length towards the apex of the cone, the longest c. 2 cm long. Seeds 2.3–2.7 cm × 1.9–2.3 cm, the sarcotesta orange to scarlet when ripe. **Fig. 1.**

Specimens examined: No specimens of this species occur in the collection at BRI.

Distribution and habitat: Locally common on escarpments of the Expedition Range to the north of Injune and probably also in adjacent ranges. It grows in sandy soil in tall

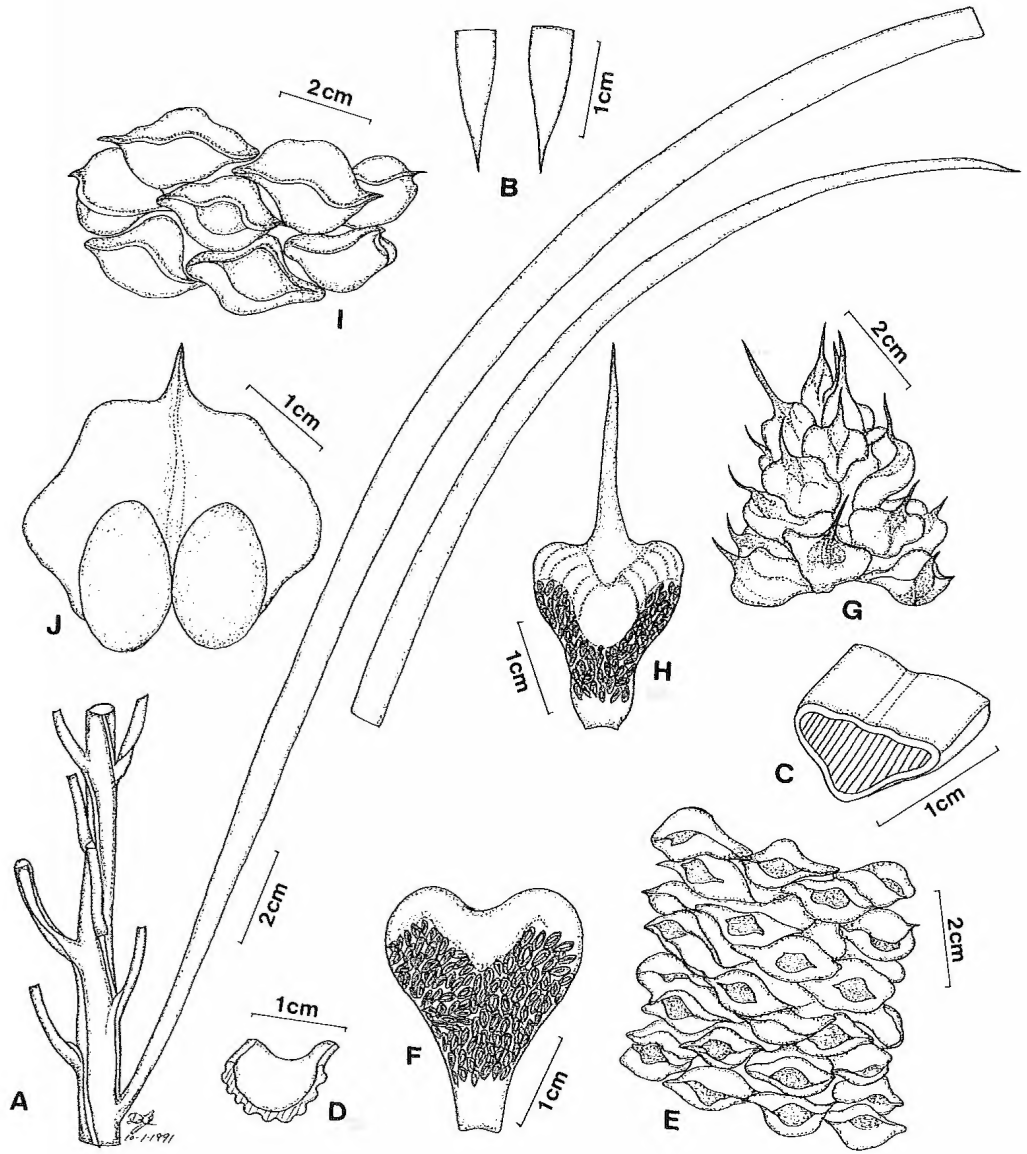


Fig. 1. *Macrozamia fearnsidei*: A. portion of rhachis and one pinna. B. tips of pinnae. C. TS of rhachis. D. TS of pinna. E. basal portion of male cone. F. male sporophyll (from below) from basal portion of cone. G. apical portion of male cone. H. male sporophyll (from below) from apical portion of cone. I. portion of female cone. J. female sporophyll. From Jones 6307.

open eucalypt forest either in gullies near ephemeral streams or on rocky slopes, sometimes in association with *Macrozamia moorei* F. Muell.

Phenology: Cones mature September – October; seeds ripen February – April.

Notes: *M. fearnsidei* is a distinctive component of the complex which surrounds *M. pauli-guilielmi*. It has the most robust plants of the group which have up to 20 fronds in the crown (*M. pauli-guilielmi* usually has only 2–5). The pinnae, which are much longer and broader than those in *M. pauli-guilielmi*, are strongly concave in cross-section and dark green and shiny on the upper surface (those in *M. pauli-guilielmi* are shallowly concave and dull). Male and female cones of *M. fearnsidei* are much larger than those of *M. pauli-guilielmi* and the majority of their sporophylls, especially those on the male cones, have only a vestigial apical spine (this spine is well developed on most sporophylls of *M. pauli-guilielmi*). *M. plurinervia* also has affinities with *M. fearnsidei* but its leaflets are shorter, duller and much more leathery. *M. platyrachis* F.M. Bailey is the closest member of section *Parazamia* geographically to *M. fearnsidei* but is not closely related and can be readily distinguished by its nearly prostrate fronds which have hardly any twist in the rachis. In common with most other species in the genus, the leaves of *M. fearnsidei*, especially those of the new growth after fire, are highly toxic to cattle (G. Fearnside, pers. comm.).

Conservation status: Locally common although not known to be protected by any security of tenure.

Etymology: Named in honour of Geoff Fearnside, owner of Wallaroo Station, in recognition of his successful combination of cattle farming with conservation practices on the property.

***Macrozamia lomandroides* D. Jones sp. nov.** affinis *M. fawcettii* C. Moore pinnis rigide erectis confertis numerosioribus textura crassiore, rhachidi distincte complanata vel vadose concava supra differt. **Typus:** Queensland, WIDE BAY DISTRICT: c. 26.5 km south of Bundaberg beside the road to Goodwood, 29 September 1990, D.L. Jones 6341 & B.E. Jones (holo: CBG; iso: CBG,BRI,NSW).

Caudex more or less ovoid, 10–17 cm diameter, subterranean. Fronds 30–80 cm long on mature plants, dull green 2–6 in an erect or spreading crown; petiole 6–14 cm long, c. 8–10 mm across above the woolly, expanded base, pale green, dull, flat or shallowly concave above, strongly rounded beneath, two raised marginal ridges fairly prominent; rachis spirally twisted 1–8 times, 10–14 mm across at the lowest pinnae, the cross-section similar to that of the petiole, with a pale green to cream marginal band especially noticeable in the distal two-thirds. Pinnae linear to slightly obovate, 20–30 cm × 0.9–1.4 cm, hypostomatic, straight or falcate, coriaceous, dark green and dull above, paler with 10–16 raised veins beneath, shallowly concave in cross-section, tapered to a relatively long, narrow base, callous base pale green to cream, apex with 1–6 sharp teeth on the acroscopic side, 1 or 2 on the basiscopic side, asymmetrical (often curved), 50–90 per frond, arising at a steep angle to the rachis, then stiffly erect to obliquely spreading, arranged more or less in two ranks but not always in opposite pairs, crowded, the longest pinnae towards the base of the frond. Male cones more or less cylindrical, 12–15 cm × 4–5 cm, usually curved with age; peduncle 8–15 cm × 1–1.2 cm, elliptical in cross-section; sporophylls transversely ovate, 1.2–1.8 cm × 1.8–2.2 cm, those in the proximal two-thirds of the cone with vestigial spines, distal ones with stiff, pointed spines to 0.8 cm long. Female cones more or less ovoid, 12–18 cm × 7–9 cm, erect; peduncle 10–15 cm × 1–1.2 cm, elliptical in cross-section, hairy at the base; sporophylls with stipe 0.7–1 cm long, transversely ovate, 1.4–1.8 cm × 2.5–3.5 cm, with a prominent depression just below the apical spine, spines increasing in length towards the apex of the cone, the longest c. 3 cm long. Seeds 2.2–2.6 cm × 1.8–2.2 cm, the sarcotesta orange to red when ripe.

Specimens examined: No specimens of this species occur in the collection at BRI.

Distribution and habitat: Reported by cycad growers to occur in several sites south of Bundaberg between the Elliot River and the Isis River. It grows among grass in grey silty loam under tall open forest. Topography is usually flat but one site is on a slope with the plants growing amongst rocks.

Phenology: Cones mature October and November; seeds ripen March and April.

Notes: *M. lomandroides* is a distinctive species which probably has as its closest congener *M. fawcettii* from New South Wales. It can be distinguished from that species by the thicker-textured, stiffly erect pinnae which impart a distinctive crowded appearance to the fronds. Those of *M. fawcettii* are thinner and spread widely from the rhachis in a whorled appearance. The flat or shallowly channelled abaxial surface on the petiole and rhachis of *M. lomandroides* is also distinctive because in *M. fawcettii* this organ is completely round in cross section. The two species are separated geographically by a distance of about 400 km. *M. lomandroides* can be immediately distinguished from all other *Macrozamia* species in Queensland by the many, small, sharp teeth on the apex of the pinnae of mature fronds, these being particularly prominent on the acroscopic margin. Clumps of this species bear a strong resemblance to large plants of some species of *Lomandra*.

Conservation status: Not conserved and although locally common in small areas it is threatened by land clearing, with much of its habitat already converted to sugar cane production; suggest 2E according to Briggs and Leigh (1988).

Etymology: Resembling the genus *Lomandra*.

New Combination

Macrozamia pauli-guilelmi is a complex of taxa which was treated by Johnson (1959) as consisting of three subspecies. My field studies, which include visits to the vicinity of the type localities of all taxa, show that each of these is isolated and habitat specific and has unique characters. I am unable to locate any of the intermediates mentioned by Johnson and find that most members of this group grow in isolated colonies, especially those which occur in inland regions. In addition to *M. pauli-guilelmi* for the type subspecies, *M. flexuosa* C. Moore is available at specific rank for *M. pauli-guilelmi* subsp. *flexuosa* and *M. pauli-guilelmi* subsp. *plurinervia* is here raised to specific rank for the third taxon.

Macrozamia plurinervia (L. Johnson) D. Jones **comb. et. stat. nov.** *M. pauli-guilelmi* subsp. *plurinervia* L. Johnson, Proc. Linn. Soc. New South Wales 84: 108 (1959).
Typus: Reedy Creek Station, near Bonshaw, New South Wales, April 1956, J. Leader (NSW 40958) (holo: NSW).

Distribution and habitat: Lower slopes and western parts of the Northern Tablelands, Central-western Slopes (upper Hunter Valley) and North-western Slopes of New South Wales and southern parts of the Darling Downs District of Queensland. This species grows in small colonies on ridges, protected slopes and gullies in sparse or stunted woodland, often with *Callitris* spp.

Notes: *M. plurinervia* can be distinguished from both *M. pauli-guilelmi* and *M. flexuosa* by its broader, stiffer, thicker-textured, dark green to nearly glaucous pinnae with the apex tapering fairly suddenly to the mucro and by its glaucous cones. It is a species of drier, inland habitats whereas *M. pauli-guilelmi* is strictly coastal and *M. flexuosa* extends from coastal cliffs to adjacent near-coastal ranges and valleys.

Macrozamia mountperriensis Bailey

Macrozamia mountperriensis was reduced to synonymy by Johnson (1959) who regarded the taxon as being a smaller form of *M. miquelii* (F. Muell.) A. DC., from drier, more inland country. It is however a stable taxon which is locally abundant in the Mount Perry region, exhibits remarkably little variation in the wild and retains its distinguishing characteristics in cultivation. For these reasons it is here recognised at specific rank. It can be distinguished from *M. miquelii* by its smaller fronds with proportionately longer petioles, the absence of reduced, spine-like proximal pinnae, much smaller cones and smaller seeds. It grows in large colonies on protected slopes and ridges in gravelly loam under sparse, tall eucalypt forest.

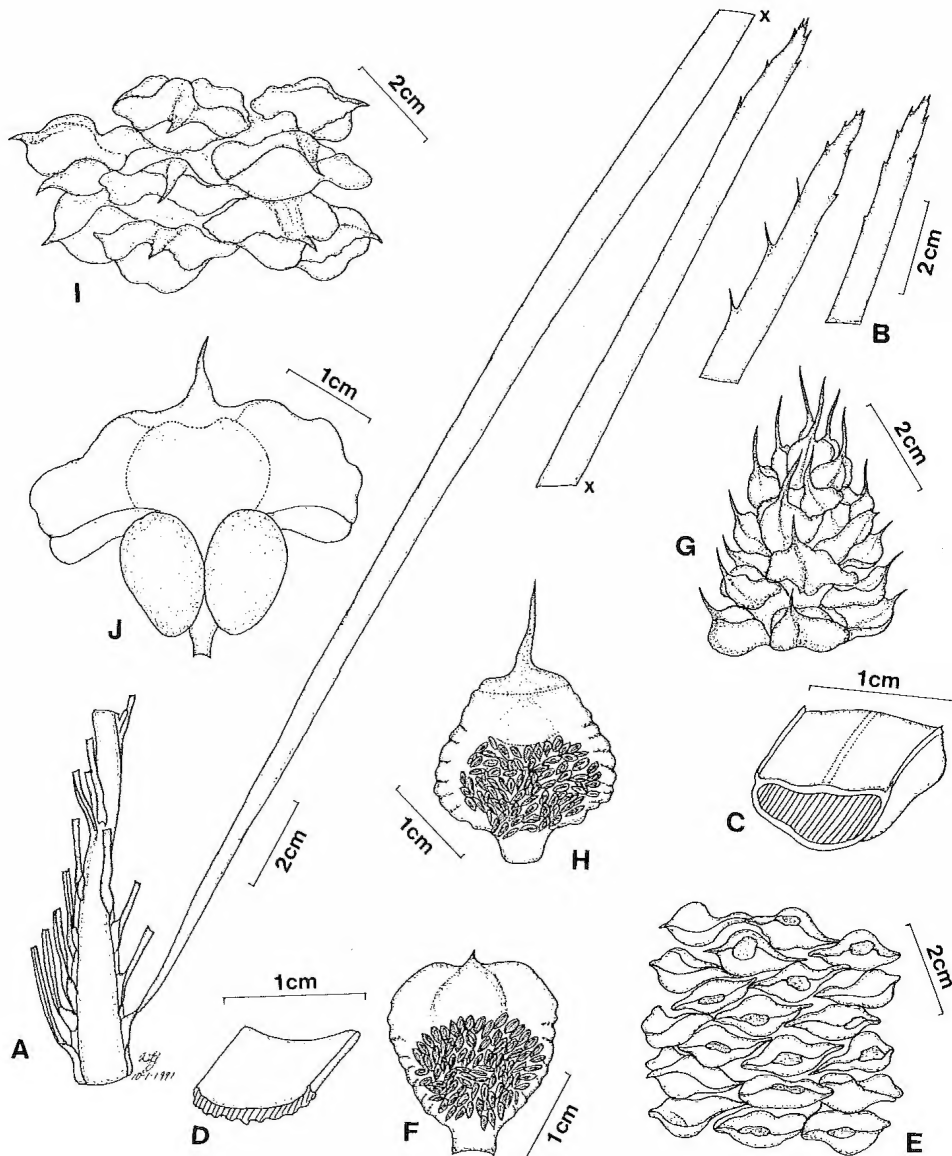


Fig. 2 *Macrozamia lomandroides*: A. portion of rhachis and one pinna. B. tips of pinnae. C. TS of rhachis. D. TS of pinna. E. basal portion of male cone. F. male sporophyll (from below) from basal portion of cone. G. apical portion of male cone. H. male sporophyll (from below) from apical portion of cone. I. portion of female cone. J. female sporophyll. From Jones 6341.

Key to the Queensland species of *Macrozamia*

1. Rhachis with a gentle spiral twist less than 180° 2
 Rhachis with at least one spiral twist of 360° usually several such twists
 per frond 6
2. Fronds held more or less horizontal, rhachis recurved near the
 base *M. platyrachis* Bailey
 Fronds erect to obliquely erect, rhachis straight or gently curved 3
3. Proximal pinnae reduced and spine-like 4
 Proximal pinnae slightly shorter than median pinnae but not reduced to
 spines 5
4. Reduced pinnae extending nearly to the base of the frond, pinnae dull
 and thick-textured *M. moorei* F. Muell.
 Reduced pinnae stopping well short of the frond base, pinnae shining and
 thin-textured *M. miquelii* (F. Muell.) A. DC.
5. Pinnae mostly more than 0.7 cm wide, widely spreading to recurved
 *M. lucida* L. Johnson
 Pinnae mostly less than 0.5 cm wide, directed forwards at an acute
 angle *M. mountperriensis* Bailey
6. Pinnae held stiffly erect, with 3 or more spine-like, apical teeth
 *M. lomandroides* D. Jones
 Pinnae held obliquely erect to widely spreading, with a single apiculus 7
7. Pinnae 0.2–0.5 cm across *M. pauli-guilielmi* W. Hill & F. Muell.
 Pinnae 0.8 cm across or more 8
8. Rhachis hardly twisted, fronds recurved and more or less horizontal,
 pinnae broadly linear, held obliquely erect *M. platyrachis* Bailey
 Rhachis strongly twisted, fronds erect, to obliquely erect pinnae linear,
 spreading 9
9. Pinnae to 25 cm long, dull, thick-textured, cones glaucous
 *M. plurinervia* (L. Johnson) D. Jones
 Pinnae to 60 cm long, shiny, thin-textured, cones green *M. fearnsidei* D. Jones

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NEW SPECIES AND CHANGES IN SAPINDACEAE FROM QUEENSLAND

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Summary

Four new species of Sapindaceae from Queensland viz *Atalaya collina*, *Atalaya oligoclada*, *Cupaniopsis simulatus* and *Rhysotoechia florulenta*, and a new subspecies of *Rhysotoechia bifoliolata* Radlk., viz *R. bifoliolata* subsp. *nitida* are described and notes on their distribution and affinities provided. *Jagera dasyantha* (Radlk.) S. Reyn. is a new combination based on *Guioa dasyantha* Radlk.

The relationships of *Alectryon unilobatus* S. Reyn. with *A. reticulatus* Radlk., and *Jagera discolor* L.S. Smith ex S. Reyn. with *J. dasyantha* are assessed. *A. unilobatus* is reduced to synonymy of *A. reticulatus*, and *J. discolor* to *J. dasyantha*.

Flowers of *Alectryon kimberleyanus* S. Reyn. and *Cupaniopsis dallachyi* S. Reyn. are described for the first time. Extensions of the range of *Alectryon subdentatus* forma *pseudostipularis* Radlk., and *Atalaya calcicola* S. Reyn. are recorded.

Introduction

Increased collecting in recent years has added to the number of representative specimens of many of the Sapindaceae, dealt within my revisions in *Austrobaileya* (Reynolds 1981–84). A few new species have been discovered in the genera *Atalaya*, *Cupaniopsis* and *Rhysotoechia*, and some previously poorly known species are now well represented. Extensions of the range of *Atalaya calcicola* and *Alectryon subdentatus* are recorded, and the relationships of some closely related species in *Jagera* and *Alectryon* are assessed.

Rhysotoechia Radlk.

This is one of a few genera of Sapindaceae in which no new taxa were recognised when it was revised (Reynolds 1984, 1985), but in recent years two new taxa have been collected from north Queensland, viz from Mt Lewis, and from Mt White near Coen. Both new taxa have petals which are furnished with scales and are therefore referable to section *Rhysotoechia* (fide Radlkofer 1933).

The key to the species (Reynolds 1985) is modified to include the new species as follows:

1. Petals furnished with scales 2
 Petals scaleless, sometimes with slightly thickened basal margins 4
2. Leaves with 1 (rarely 2) pairs of leaflets; petiolules 1–7 mm long. Fruits sessile or subsessile **R. bifoliolata**
 Leaves with 2–4 (rarely 1) pairs of leaflets; petiolules 8–18 mm long. Fruits usually conspicuously stipitate 3
3. Leaves with 2 or 3 pairs of leaflets; apex of leaflets usually acute or acuminate; reticulate venation lax. Inflorescences sparsely flowered. Flowers 8–10 mm diameter; pedicels 6–9 mm long. Sepals to 6 × 5 mm. Petals 4–5 mm long **R. mortoniana**
 Leaves with 2–4 pairs of leaflets; apex of leaflets broad, obtuse; reticulate venation fine, close together. Inflorescences densely flowered. Flowers 6–7 mm diameter; pedicels 4–5 mm long. Sepals to 4 × 3 mm. Petals 2.5–3 mm long **R. florulenta**

4. Branchlets glabrous at tips; leaflets very vernicose, finely closely reticulate-veined; petiolules 7–10 mm long. Fruits 2-locular **R. flavescens**
 Branchlets villous at tips; leaflets shiny, lax and coarsely reticulate-veined; petiolules 2–6 mm long. Fruits 3-locular **R. robertsonii**

Rhysotoechia bifoliolata Radlk., Sitzungsber. Bayer. Akad. 9: 541, n. 591, 656 (1879).

A new taxon which strongly resembles *R. bifoliolata* was collected at Mt White near Coen, north Queensland in June 1989. It has the leaves, flowers and fruits (dried ones) of typical *R. bifoliolata*, but differs from it in its shorter petioles, very vernicose leaflets and smaller flowers. Because of these differences and disjunct distribution (*R. bifoliolata* has not been recorded north of Gladstone before (Map 1)), the new taxon is treated here as a subspecies of *R. bifoliolata*.

The subspecies may be distinguished as follows:

- Petioles (7–)20–31 mm long. Leaflets 1 or 2 pairs per leaf, elliptic or elliptic-obovate, margins flat or recurved; upper surfaces glossy; lateral nerves usually $\pm$ patent. Branches of panicles to 3 cm long. Flowers 5–7.5 mm diameter subsp. **bifoliolata**
 Petioles 4–8(–11) mm long. Leaflets 2 per leaf, elliptic, margins flat; upper surfaces very vernicose; lateral nerves $\pm$ oblique. Branches of panicles 4–9 cm long. Flowers 4.5–5.5 mm diameter subsp. **nitida**

R. bifoliolata Radlk. subsp. **bifoliolata**

Distinguishing characters as in the key above. For description etc. refer to *Austrobaileya* (Reynolds 1984, pp. 41–42).

R. bifoliolata subsp. **nitida** S. Reyn. subsp. nov. a subsp. *bifoliolatae* petiolis brevioribus (4–11 mm longis), foliolorum nervis lateralibus plerumque $\pm$ obliquis et floribus parvioribus differt. **Typus:** Queensland. COOK DISTRICT: Northern slopes of Mt White, about 2.8 km from Coen, 10 July 1990, *E.M. Ross* s.n. (holo: BRI; iso: BRI).

Small trees, glabrous except for sparsely hairy young parts and peduncles. Petioles 4–11 mm long, mealy; leaflets 2 per leaf, elliptic, apex broad, obtuse or retuse, base subacute, decurrent into petiolules, margins flat, (4.4–)5.5–6(–8.5) $\times$ (1.4–)2–3.6 cm, thick, rigid, very vernicose above; lateral nerves $\pm$ oblique, looping at tips; petiolules 1–3(–5) mm long. Panicles 5–12 cm long, branches 4–9 cm long. Flowers and old fruits as in the typical subspecies.

Specimens examined: Queensland. COOK DISTRICT: Mt White, Coen, 13°56'S, 143°11'E, Jun 1989, *Forster* 5528 (BRI); ditto, Jul 1990, *Ross* s.n. (BRI).

Distribution and habitat: Known only from the type locality (Map 1). It grows on steep hillsides and scree slopes, in deciduous vine thickets.

R. bifoliolata subsp. **nitida** is distinguishable from the typical subspecies in the short petioles and petiolules, very vernicose upper surface of leaflets and $\pm$ oblique lateral nerves.

Etymology: the subspecific epithet “nitida” (from the Latin *nitidus*, shining or polished) refers to the very shiny leaflets.

Rhysotoechia florulenta S. Reyn. sp. nov. ab aliis speciebus Australianis foliolis 2–4 jugatis, ellipticis obtusis, venatione reticulata conferta, inflorescentiis magnis, florulentis, petalis squamis ornatis distinguenda. **Typus:** Queensland. COOK DISTRICT: S.F.R. 143, Parish of Kanawarra, Carbine L.A., Mt Lewis, 16°29'S, 145°16'E, alt. 1100 m, 16 October 1989, *B. Gray* 5129 (holo: BRI; iso: BRI).

Tree to 15 m tall, glabrous except for flowers, branchlets usually with a whitish bloom; lenticels scattered, ellipsoid. Leaves with 2–4 pairs of opposite or subopposite leaflets; petioles terete, pulvinate, 3.2–4.5 cm long; rachis 3–9 cm long, terete; leaflets elliptic, obtuse at both ends, base sometimes suboblique, 7.1–11.5 $\times$ 3.4–5.7 cm, coriaceous, upper surfaces very shiny and vernicose, lower ones glossy, usually with minute slender

glands on both surfaces; lateral nerves 6–8 pairs, $\pm$ patent; reticulate venation close together, conspicuous both surfaces; petiolules terete, pulvinate, 1–1.7 cm long. Panicles in upper axils or in axils of fallen leaves, thyrsiform, usually large, 10–40 $\times$ 5–40 cm, laxly branched, densely flowered; bracts and bracteoles ovate, minute. Flowers cream, 6–7 mm diameter; pedicels 4–5 mm long; outer calyx lobes broadly ovate, obtuse, to 3 $\times$ 2.5 mm, inner ones broadly elliptic-obovate, concave, to 4 $\times$ 3 mm; green or cream, resin-dotted, viscid, margins pale, ciliolate; petals broadly ovate, with broad apex and short claw at base, 2.5–3 mm long including claw, 2.5–3.2 mm wide, lower margins with 2 prominent scales and crest-like appendages; sparsely hairy on the scales and on the outside of petals from above the middle to base; scales often as long as the lamina of the petal; disc glabrous, fleshy; stamens to 3 mm long, filaments to 2.5 mm long, subulate, hairy towards base, anthers glabrous; ovary subglabrous, style short. Fruits not seen.

Distribution and habitat: Known only from type habitat (Map 1).

R. florulenta differs from other species occurring in Australia by the combination of 2–4-paired elliptic leaflets per leaf, reticulate venation close together, large many-flowered inflorescences, and petals furnished with scales.

Etymology: The specific epithet “*florulenta*” (from the Latin *florulentus*, abounding in flowers or profusely flowering) refers to the large, profusely flowering inflorescences.

Atalaya Blume

Since the genus was revised (Reynolds 1981, 1985) two new species (described below) have been discovered, and the number of representative specimens of some of the previously poorly known *Atalaya* species have increased. An extension of the range of distribution of *Atalaya calcicola* S. Reyn. from north to central Queensland was also recorded. The increased number of specimens also increased the known variability in some of the species viz *Atalaya salicifolia* (A. DC.) Blume, and in the *Atalaya australiana* Leenh. – *A. sericopetala* S. Reyn. complex (as discussed in Reynolds 1981, 1985).

The key to the species (Reynolds 1981, 1985) is modified to accommodate the new species as follows:

1. Leaves simple *A. sericopetala* 2
 Leaves pinnate (juvenile or abnormal leaves sometimes simple)
2. Rachis and petiole with broad leaf-like wings; leaflets sessile or
 subsessile *A. variifolia* 3
 Rachis and petiole with narrow wings or wingless; leaflets stalked, rarely
 subsessile
3. Rachis and petiole usually winged, especially in juvenile leaves 4
 Rachis and petiole even in juvenile leaves wingless 7
4. Leaflets 4–11 pairs per leaf, 2–5 mm wide *A. angustifolia* 5
 Leaflets 1–4(–6) pairs per leaf, 5–27 mm wide
5. Leaflets 2–4 pairs per leaf, 10–27 mm wide, 2–4 times as long as wide.
 Small spindly shrubs with few branches, 0.5–3 m high *A. oligoclada*
 Leaflets 1–4(–6) pairs per leaf, 5–20 mm wide, 4–40 times as long as
 wide. Small trees to 10 m high 6
6. Leaflets glaucous especially below, mostly hairy. Flowers and fruits
 usually hairy *A. hemiglaucula*
 Leaflets green and glabrous on both surfaces. Flowers and fruits usually
 glabrous *A. salicifolia*
7. Leaflets 2 per leaf, glaucous below; petioles and rachis with curled
 hairs *A. calcicola*
 Leaflets 2–8 per leaf, glaucous or green below; petioles and rachis with
 short straight hairs 8

8. Petals 4 per flower, scales crested. Disc incomplete. Leaflets 1 or 2 pairs per leaf, $\pm$ glaucous below; lateral nerves oblique, close together, decurrent on the midrib **A. multiflora**
 Petals 5 per flower, scales without crests, sometimes with minute appendages. Disc complete. Leaflets 1–4 pairs per leaf, green below; lateral nerves not as above, usually $\pm$ patent and not close together 9
9. Outside of petals densely sericeous all over. Leaflets (2–)4 pairs per leaf **A. sericopetala**
 Outside of petals glabrous or hairy from above middle to base, the apical area usually glabrous. Leaflets 1–4 pairs per leaf 10
10. Leaflets drying hard and rigid, yellowish, vernicose, conspicuously reticulate-veined, often truncate and unequal at base. Petiolules (5–)10–35 mm long. Leaflets 3 or 4 (rarely 2) pairs per leaf **A. rigida**
 Leaflets not as above, usually drying greenish, thinly coriaceous, finely reticulate-veined, usually $\pm$ acute or obtuse at base. Petiolules 1–5(–8) mm long. Leaflets 1–4 pairs per leaf 11
11. Leaflets 1 or 2 pairs per leaf, usually narrowly elliptic, obtuse or $\pm$ acute at both ends, 1.7–4.5(–6) cm wide; petiolules 1–4.5 mm long. Petals densely hairy outside **A. collina**
 Leaflets 2–4 (rarely 1) pairs per leaf, narrowly elliptic to obovate-elliptic, apex acute, obtuse, or subacuminate, base acute or obtuse, 3–5(–6.5) cm wide; petiolules (3–)6–8 mm long. Petals glabrous or sparsely hairy outside **A. australiana**

Atalaya collina S. Reyn. sp. nov. *A. multiflorae* Benth. similis sed foliis plerumque anguste ellipticis obtusis vel subacutis, floribus quinquepetalis, petalis pubescentibus, squamis plerumque sine cristis, discis completis, annularibus. **Typus:** Queensland, PORT CURTIS DISTRICT: Yarwun area 4 km SSW of Yarwun, 23°53'S, 151°06'E, 10 November 1990, *N. Gibson* 950 (holo: BRI; iso: BRI).

Small spreading trees to 5 m; bark light grey brown, rough; young parts and peduncles sparsely appressed hairy; branchlets with prominent, small, linear or globose, pale or white lenticels. Leaves with 1 or 2 pairs of leaflets; petioles 2.2–6.5(–7) cm long, shortly pulvinate, sparsely hairy with fine, short hairs; rachis 2.5–5 cm long, adaxially ridged, glabrous or subglabrous; leaflets usually narrowly elliptic, obtuse or subacute at both ends, or decurrent into petiolule at base, 5.2–12.5(–14) $\times$ 1.7–4.5(–6) cm, glabrous or lower surfaces sparsely hairy; thinly coriaceous to semi-rigid upper surfaces glossy green, drying pale brown, lower ones paler green, drying olive green; midrib pale, prominent below; lateral nerves fine, 10–14 pairs, $\pm$ patent, looping at margins, prominent; petiolules 1–4.5 mm long, often tumid, hairy. Panicles 9–26 $\times$ 5–18 cm, densely flowered, peduncles $\pm$ angular; bracts ovate, about 1 $\times$ 0.5 mm. Flowers 8–10 mm diameter; pedicels 2–5 mm long, glabrous or subglabrous; sepals elliptic, 2.5–3.5 $\times$ 2–3.5 mm, glabrous or subglabrous, ciliate; petals obovate, 5–6.5 $\times$ 2.5–4 mm, densely hairy on the outside from above middle to base with appressed hairs, except glabrous apical area, ciliate; scales 2-lobed, hairy, sometimes with crest-like appendages; disc complete, annular, fleshy, glabrous; filaments 3–4 mm long, hairy; ovary 3-lobed, densely hairy. Fruits 2-lobed; samarae 2.3–4.5 cm long, upper margin with a dark brown area; wings divaricate, depressed obovate, oblique, with rounded or subtruncate apex and undulate margins, 0.9–2 cm wide at broadest part; fruit portion puberulent, wings glabrous. **Fig 1D–F.**

Specimens examined: Queensland, PORT CURTIS DISTRICT: Mt Sugarloaf area, 4 km SSW of Yarwun, Calliope Shire, Dec 1983, *Gibson* s.n. (BRI)(fruiting); ditto, Nov 1990, *Gibson* 950 (BRI)(flowering); ditto, Dec 1990, *Gibson* 953 (fruiting).

Distribution and habitat: Known only from the type locality (**Map 2**). It grows on hillsides, in remnant dry scrubs, together with *A. salicifolia*, but is not as common as that species.

A. collina is distinguishable by the leaves with 1 or 2 pairs of usually narrow elliptic leaflets with obtuse or subacute tips, large inflorescences, hairy petals and glabrous

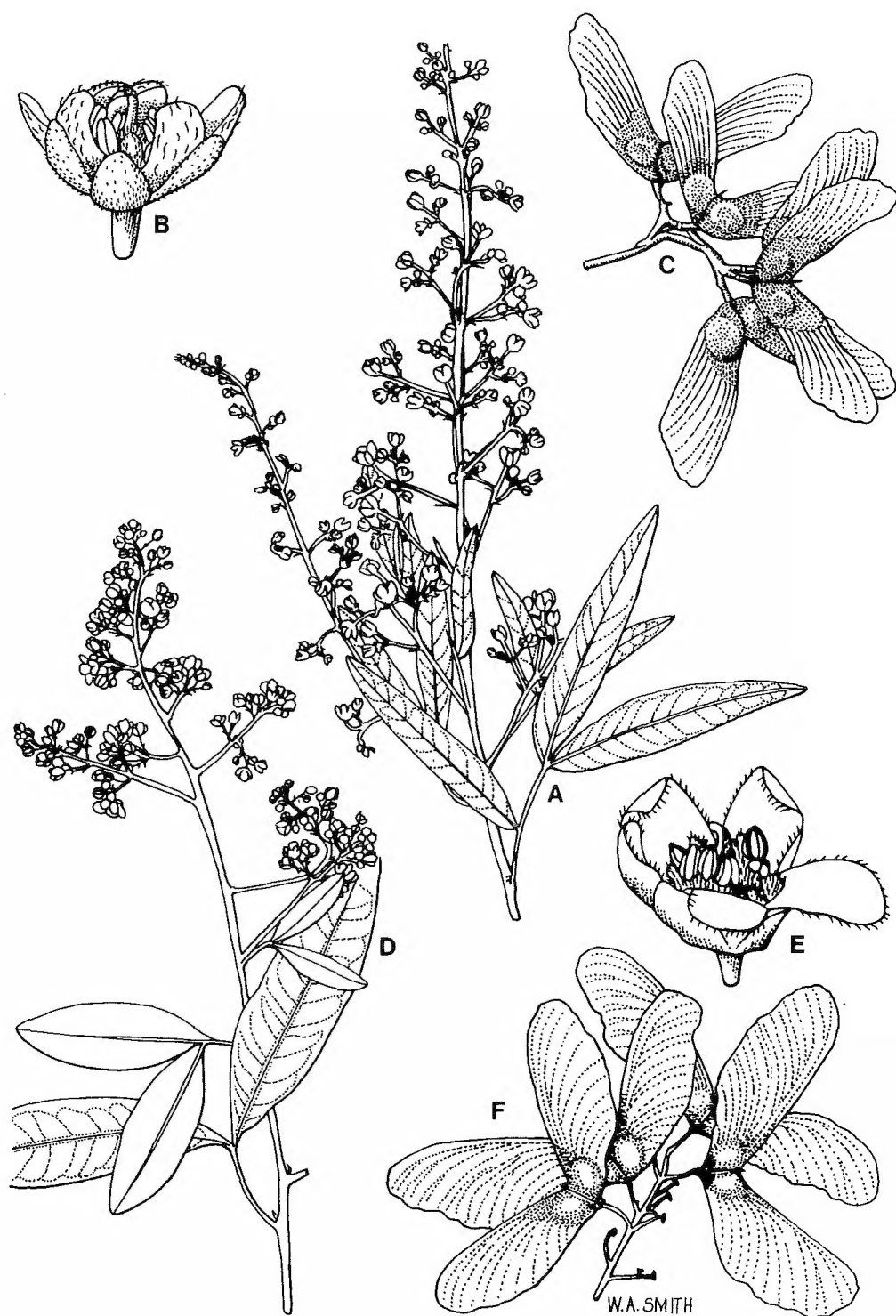


Fig. 1. *Atalaya* spp.: A-C. *A. oligoclada*: A. flowering habit $\times 0.67$. B. flower $\times 4$. C. fruits $\times 1$. D-F. *A. collina*: D. flowering habit $\times 0.67$. E. flower $\times 4$. F. fruits $\times 1$. A,B, Clarkson 5487; C, Coveny 6980 & Hind; D,E, Gibson 469; F, Gibson 953.

fruits. It is similar to *A. multiflora*, but the leaves are with 1 or 2 pairs, of oblong or obovate-elliptic leaflets with broad, truncate or retuse apices, the lateral nerves decurrent on the midrib; petals 4 per flower and crested, and disc incomplete in that species. The leaves are green in colour as in *A. salicifolia*, but the leaflets are usually much narrower, and the petiole and rachis usually winged in that species. *A. salicifolia* also has an earlier flowering period than that of *A. collina*, it was said to be fruiting by the time *A. collina* came into bloom.

Etymology: The specific epithet "collina" (from the Latin *collinus*, pertaining to hills) refers to the habitat, viz hillsides in which these plants grow.

Atalaya oligoclada S. Reyn. sp. nov. *A. angustifoliae* S. Reyn. proxima, cujus statura, foliorumque texturam et formam habet. Differt vero foliolis plerumque latoribus, 2-4-jugatis, inflorescentiis multo magnis et ramulis, foliolis, pedunculis et sepalis pubescentibus. **Typus:** Queensland. COOK DISTRICT: 7.7 km south of Lakeland Downs on Peninsula Development road, 15°55'S, 144°50'E, alt. 280 m, 4 September 1984, J.R. Clarkson 5487 (holo: BRI; iso: BRI,DNA,K,L,PERTH,QRS).

Small shrubs 0.5-3 m high, usually sparsely branched and spindly; young parts and peduncles densely hairy with short spreading rusty hairs; branchlets with white, linear lenticels. Leaves with 2 or 3 (rarely 4) pairs of leaflets; petioles 1.2-3 cm long, shortly pulvinate; rachis 1-7.5 cm long, adaxially ridged, sometimes narrowly winged; leaflets subsessile, elliptic or narrowly elliptic-ovate, subacute or obtuse at both ends, or base oblique, 6.1-9.2 × (1-)2-2.7 cm (uppermost pair usually smallest), thinly coriaceous; upper surfaces drying brownish, glabrous or finely puberulent, lower ones olive-greenish, usually hairy; lateral nerves 8-11 pairs, oblique, prominent, as fine as the reticulate venation; petiolules tumid, to 1.5 mm long. Panicles usually much longer than leaves, (7-)14-25 × (4.5-)14-28 cm, peduncles slender, laxly branched. Flowers 6-8.5 mm diameter; pedicels (1.5-)3-4 mm long, hairy; sepals elliptic, 3.5-5 × 1.5-3 mm, densely appressed hairy on the outside except for the glabrous apex, ciliolate; petals obovate, 5-6 × 2-2.5 mm, densely appressed hairy all over on the outside except glabrous apical area, ciliolate; scales entire or bifid, hairy, rarely with minute, filiform appendages; disc complete, fleshy; filaments 2.5 mm long, sparsely hairy from below middle to base; ovary 3-lobed, densely hairy. Fruits 2- or 3-lobed; samarae 2.3-2.7 cm long, densely finely hairy; wings divaricate, laterally elongate, depressed obovate, oblique, subentire, to 8 mm wide at broadest part. **Fig. 1A-C.**

Selected specimens: Queensland. COOK DISTRICT: 7.7 km S of Lakeland Downs on Peninsula Development Rd, Sep 1984, Clarkson 5487 (BRI); 11.7 km SE of Mt Janet on the Survey Road along the Dividing Range, 11.5 km SW of Lakeland Downs, 15°55'S, 146°46'E, Sep 1984, Clarkson 5509 (BRI); 12.9 km S of Lakeland Downs towards Palmer River, 15°58'S, 144°50'E, Sep 1975, Coveny 6980, & Hind (BRI).

Distribution and habitat: Common near Lakeland Downs, north Queensland (**Map 2**). It usually grows on slopes and ridges in eucalypt woodlands.

A. oligoclada is nearest to *A. angustifolia* of which it has the leaves and stature. It differs in fact by its usually broader leaflets, which are only 2 or 3 (or 4) pairs per leaf (4-6(-10) pairs in *A. angustifolia*), and in the pubescent branchlets, leaves, peduncles and sepals.

A. oligoclada is distinguishable by its very low stature (sometimes only up to half a metre high), spindly shape, broad or narrow 2-4 pairs of leaflets per leaf, and large inflorescences, and also by its hairy inflorescences, fruits and leaves.

Etymology: The specific epithet "oligoclada" (from the Greek *oligo*, few and *cladus*, branched) refers to the sparsely branched habit of this species.

Atalaya calcicola S. Reyn., *Austrobaileya* 1(4): 404 (1981).

This species previously known from the Chillagoe-Almaden-Mungana areas and Fanning River, north Queensland, is now recorded from Berserker Ranges, central Queensland (**Map 3**).

Specimens examined: Queensland. PORT CURTIS DISTRICT: Berserker Range, 23°21'S, 150°34'E, Nov 1985, Hoy 108 (BRI); ditto, Hoy 108A (BRI); Mt Archer area, Berserker Ranges near Rockhampton, approx. 23°20'S, 150°35'E, May 1971, Webb & Tracey 10556 (BRI).

***Atalaya salicifolia* (A. DC.) Blume, Rumphia 3: 186 (1847)**

Recent collections of this species especially from northern Australia have shown it to be quite variable with at least two distinct forms being recognisable, e.g. plants from northern Australia, viz the Kimberley, Western Australia, Arnhem Land, Northern Territory, and northern Queensland especially the islands of Torres Strait, have large, long and broad leaflets and wide wings on rachis and petiole. They are not unlike specimens from Timor (type locality). The majority of plants from Queensland especially the southern populations, have narrow small leaflets, and usually narrow wings on rachis and petiole, or are wingless. These were previously called *Atalaya virens* C. White. These forms are not formally recognised here because they intergrade with each other.

***Atalaya australiana* Leenh. – *A. sericopetala* S. Reyn. complex**

The known variability of these species (previously discussed in Reynolds 1981, 1985), has also increased, but the representative specimens available are inadequate to determine whether more than one species is included in each of these species or if these species constitute one very variable species.

***Cupaniopsis* Radlk.**

The number of representative specimens of many of the species of this genus has also increased since my revision (Reynolds 1984, 1985). Flowering material of *C. dallachyi* S. Reyn. is now available for description, and the following new species has been discovered.

***Cupaniopsis simulatus* S. Reyn. sp. nov.** *C. anacardioide* Radlk. et *C. dallachyi* S. Reyn. primo maxime similis sed a *C. anacardioide* foliorum venis grosse valdeque reticulatis (conspicuis ubi sicco), foliorum paginis non nitidis, et fructibus plerumque aurantiacis; a *C. dallachyi* foliolis efoveolatis, petiolulis brevipulvinatis et inflorescentiis ± glabris differt. **Typus:** Queensland, WIDE BAY DISTRICT: Fairlies Knob, 10 km NNE of Brooweena, 25°30'S, 152°17'E, 3 December 1990, *P.I. Forster* 7671 (holo: BRI; iso: BRI, L, MEL, QRS).

Trees to 25 m with straight trunk; young parts finely appressed hairy; branchlets with scattered, small, ellipsoid pale lenticels. Leaves with 2–5 (or 6) leaflets on each side of rachis; petioles 3.7–8.2(–10) cm long, terete, trigonous and pulvinate at base, densely lenticellate especially near the base and on the pulvinus; rachis (2.8–)5–17.5 cm long (to 20.5 cm in juvenile leaves), subterete; pinnae alternate or subopposite, narrowly elliptic or elliptic-oblong or subobovate, obtuse, emarginate, or subtruncate at apex, acute or obtuse at base, entire, 6.5–14.5 × 2.5–5.7 cm (to 19.4 × 5.5 cm in juveniles), glabrous, pale green, ± shiny or glossy when young; midrib broad and prominent below; lateral nerves 9–14(–16) pairs, 8–12 mm apart, ± patent, arched at their tips, slightly decurrent into midrib; reticulate venation very coarse, conspicuous in a dry state; petiolules 8–12 mm long, channelled above, shortly pulvinate at base. Panicles axillary, 8–13 cm long; peduncles branched from near base; branches patent, sparsely appressed hairy, sometimes lenticellate. Flowers to 8 mm diameter; pedicels 2–3.5 mm long, subglabrous; calyx lobes elliptic or suborbicular, 2.5–4 × 2–2.5 mm, sparsely finely appressed hairy on the outside, ± glabrous towards ciliolate margins; petals broadly ovate, shortly clawed, to 2 × 1.5 mm, hairy on outside and on the scales; disc fleshy, lobed, glabrous; filaments 1.5 mm long, hairy; anthers obloid, c. 1 mm long, glabrous; ovary glabrous. Fruits subobovoid to subglobose, shortly stipitate, 3-grooved with rounded lobes, slightly carinate at sutures, 1.7–2.8 × 1.4–2.7 cm, brownish orange when ripe; aril yellow-orange maturing to orange or red. **Fig. 2.**

Specimens examined: Queensland, WIDE BAY DISTRICT: Fairlies Knob, E of Biggenden, 25°30'S, 152°18'E, Jan 1990, *Randall* 600 (BRI); between Apple Tree Creek and Childers, Jan 1990, *Randall* s.n. (BRI).

Distribution and habitat: Known only from the type locality (**Map 3**). It is usually present as a dominant tree in hoop pine (*Araucaria cunninghamii* D. Don) rainforests.

C. simulatus is distinguishable by the narrowly elliptic leaflets with prominent coarse reticulate veins, by the orange coloured fruits, and by the nearly glabrous

inflorescences. It is very similar to *C. anacardioides* and *C. dallachyi* in its aspect, and may be distinguished from them as follows:

1. Leaflets usually foveolate in the axil of the lateral nerves below. Inflorescences densely hairy. Branchlets densely lenticellate **C. dallachyi**
 Leaflets not foveolate. Inflorescences usually sparsely hairy. Branchlets sparsely lenticellate 2
2. Leaflets mostly obovate or elliptic with mostly broad retuse or obtuse apex, upper surfaces usually very vernicose and darker than below; reticulate venation fine, prominent. Peduncles pubescent. Fruits golden yellow, sometimes tinged with red, glabrous. Small spreading trees rarely more than 15 m high **C. anacardioides**
 Leaflets narrowly elliptic to subobovate with obtuse or subtruncate apex; upper surfaces not as above, slightly shiny, reticulate venation coarse, very conspicuous especially in a dry state. Peduncles sparsely hairy. Fruits orange or brown, puberulent. Tall straight trees to 25 m high **C. simulatus**

Etymology: The specific epithet "simulatus" (from the Latin *simulans*, resembling or imitating) refers to the resemblance of this species to *C. anacardioides* and *C. dallachyi*.

Cupaniopsis dallachyi S. Reyn., Fl. Australia 25: 199 (1985).

Add to the description:

Panicles 8.5–13.5(–25) × 2.5–4.5 cm, densely flowered; male flowers more numerous than females; peduncles ± angular, pubescent, usually branching from near base, branches very short; bracts ovate, densely hairy. Flowers 7–8.5 mm diameter, male and female usually nearly the same size, perfumed; pedicels 3.5–5 mm long, pubescent; calyx lobes 3–4 × 2.5–3 mm, elliptic or suborbicular, usually with dense appressed hairs on outside; petals broadly ovate, to 2 × 2 mm, white, scales sparsely hairy; disc fleshy, glabrous; filaments 2–2.5 mm long, densely patent hairy; anthers to 2 mm long; ovary glabrous.

Representative specimen: Queensland. COOK DISTRICT: S.F.R. 310, Parish of Bellenden Ker, Goldfield L.A., 17°18'S, 145°48'E, Nov 1987, Gray 4668 (BRI).

Alectryon Gaertner

The number of representative specimens of many of the *Alectryon* species has also increased since the genus was revised (Reynolds 1983, 1985, 1987). Flowering material of *A. kimberleyanus* S. Reyn. has been collected, and an extension of range of *A. subdentatus* recorded. Increased numbers of representative specimens has also made it possible to assess more closely the relationships of *A. unilobatus* S. Reyn. and *A. reticulatus* Radlk.

Alectryon kimberleyanus S. Reyn., Austrobaileya 1(5): 477 (1983).

Add to the description:

Inflorescences thyrsiform panicles, 2.7–3 cm long, to 0.8 cm wide, peduncles densely rusty hairy; bracts ovate-elliptic, 3–3.5 × 1–1.5 mm, densely appressed hairy outside. Flowers cream; calyces to 3 × 3.5 mm, sparsely hairy, lobes ovate to 1 × 1 mm; petals absent; stamens to 2.5 mm long; filaments to 1 mm long, glabrous or sparsely hairy; anthers c. 1.5 mm long, mostly glabrous.

Representative specimen: Western Australia. Lone Dingo, approx. 25 km NNW of mining campsite, Mitchell Plateau, N Kimberley, Oct 1982, Kenneally 8578 (PERTH).

Alectryon subdentatus forma **pseudostipularis** Radlk., Feddes Repert. 20: 28 (1924); Reynolds 1985, p. 30.

This form is now recorded from north of Gladstone, Port Curtis District and extends as far west as Chesterton Range, Maranoa District (**Map 4**). It had previously been recorded from only southeastern Queensland.

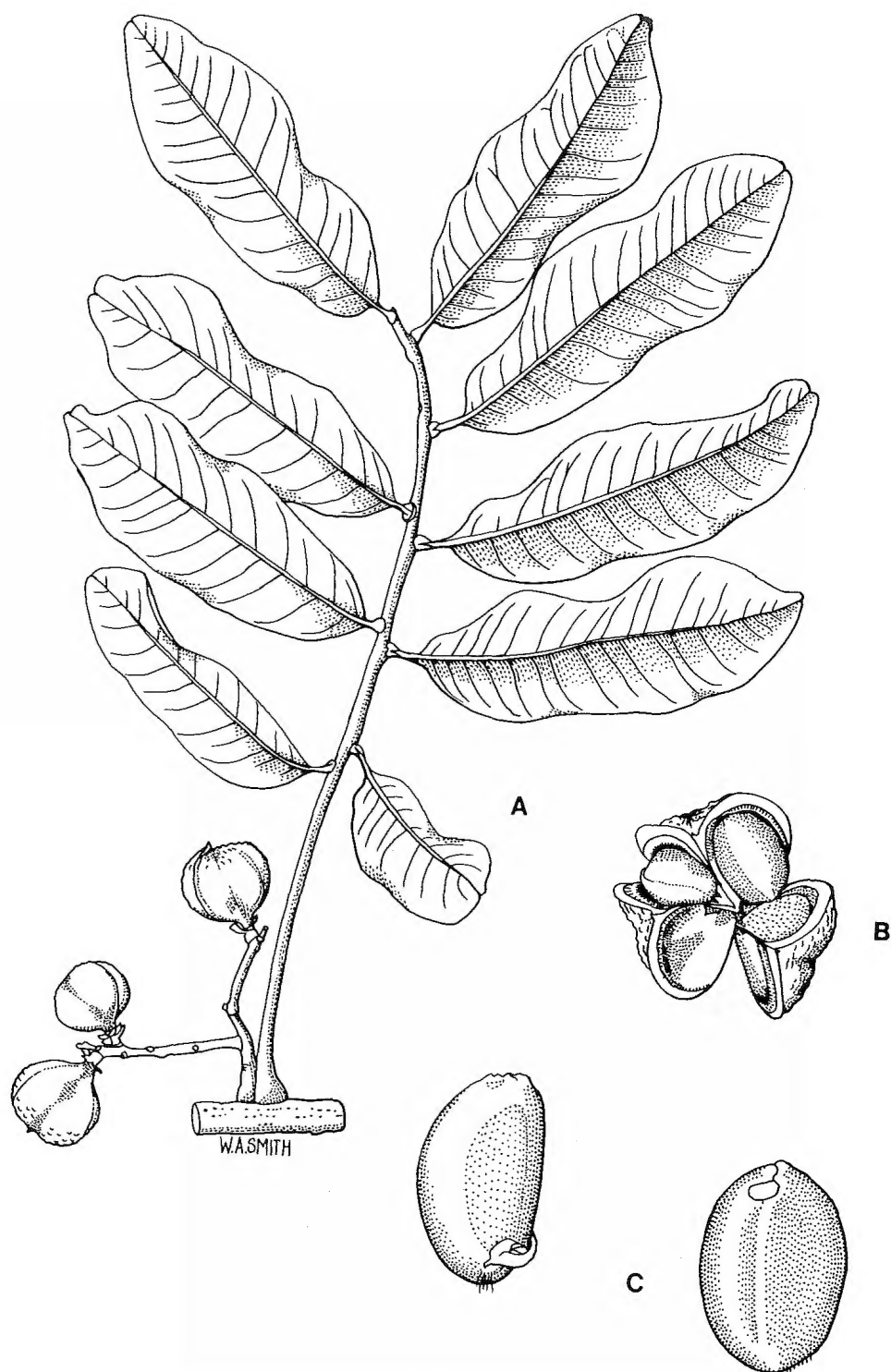


Fig 2. *Cupaniopsis simulatus*: A. fruiting habit $\times 0.5$. B. dehiscent fruit showing seeds and hairy insides of valves $\times 1$. C. seeds and aril covering $\times 2$. A-C, Forster 7671.

Representative specimens: Queensland. PORT CURTIS DISTRICT: The Caves, 23°11'S, 150°28'E, Jan 1986, *Hoy* 157 (BRI); S.F. 60, Rundle Range, 23°38'S, 150°58'E, Dec 1987, *Gibson* 1035 (BRI); Beecher S.F. 150, Por. 75, Calliope Shire, 23°55'S, 151°11'E, Nov 1987, *Gibson* 1011 (BRI). MARANO DISTRICT: Chesterton Range, Mt Moffatt section of Carnarvon National Park to NW of Marlong Plain and SW of Mt Sugarloaf (c. 90 km SW of Rolleston and 14 km N of National Park Head Quarters), 24°56'S, 147°56'E, Nov 1990, *Henderson* H 3505 & *Robins* (BRI).

A. reticulatus Radlk. and **A. unilobatus** S. Reyn.

The close relationship of these two species was noted when *Alectryon unilobatus* was described (Reynolds 1983, p. 476). It was also noted by Dr Leenhouts in his revision of *Alectryon* (1988, p. 327).

When *A. unilobatus* was described, it was represented in herbaria by a few variable specimens. Although these appeared to match quite well with the description of *Alectryon reticulatus* Radlk. from New Guinea, especially in the characteristic 1-lobed fruits, no specimen of this species was available for comparative study. Moreover because *A. unilobatus* appeared to contain two $\pm$ distinct forms represented by northern and southern collections, no attempt was made to assess the relationship of the two species, at that time.

The number of available representative specimens of *A. unilobatus* has increased substantially since it was described, its two forms present are now also better represented in herbaria, and one of two specimens of *A. reticulatus* Radlk. cited by Leenhouts (1988) has become available for study. This latter specimen viz *Hartman* s.n. (MEL 1537050) from Torres Strait, Queensland, matches most of the specimens from north Queensland including the type of *A. unilobatus* from Pascoe River, it differs slightly in the leaves from those of the southern collections.

Although the type of *A. reticulatus* Radlk., from the islands in the Gulf of Papua has not been seen, I am quite confident that this species is conspecific with *A. unilobatus* S. Reyn. so the latter name is now reduced to synonymy under *A. reticulatus* Radlk., the earlier name.

Alectryon reticulatus Radlk., Sitzungsber. Bayer. Akad. 20: 255(1890). **Type:** SE New Guinea, islands in the Gulf of Papua, before 1886, collector unknown (holo: M, n.v.).

A. unilobatus S. Reyn., Austrobaileya 1(5): 475–476 (1983). **Type:** Queensland. COOK DISTRICT: Pascoe River, in 1977, *L.J. Webb* & *J.G. Tracey* 13123 (holo: BRI)

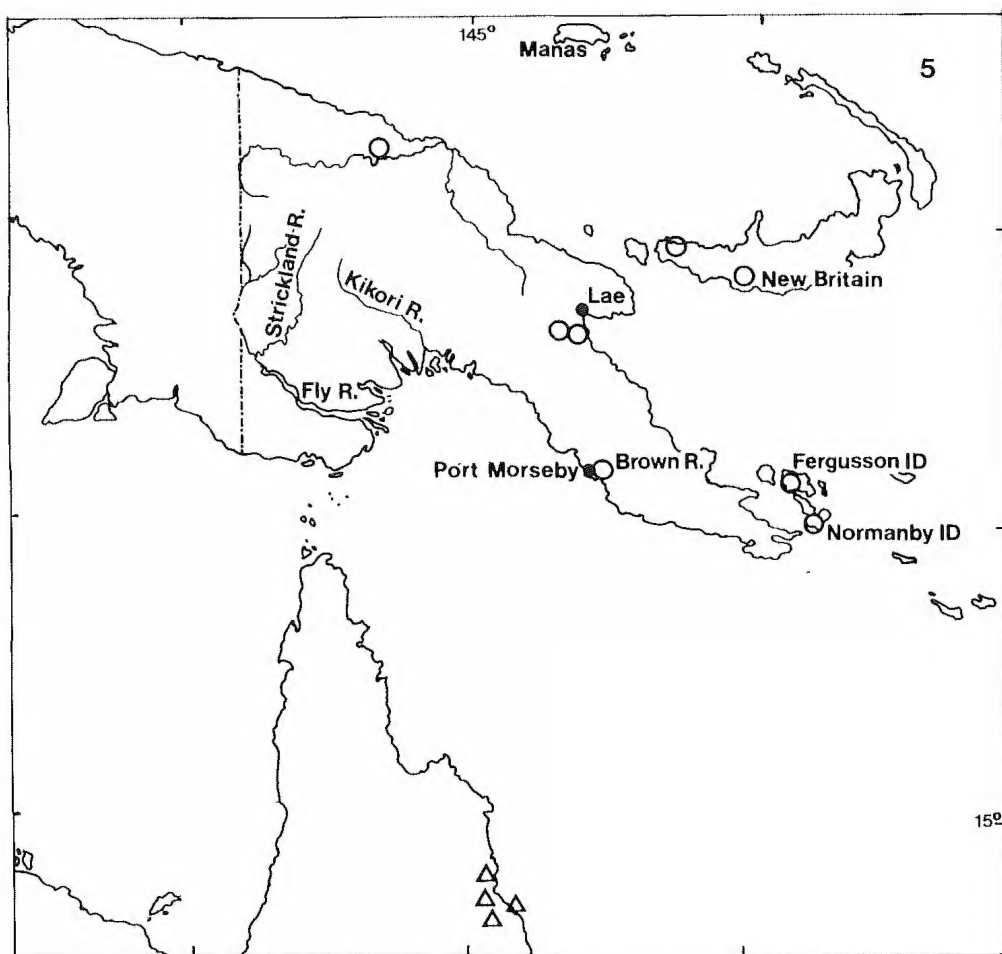
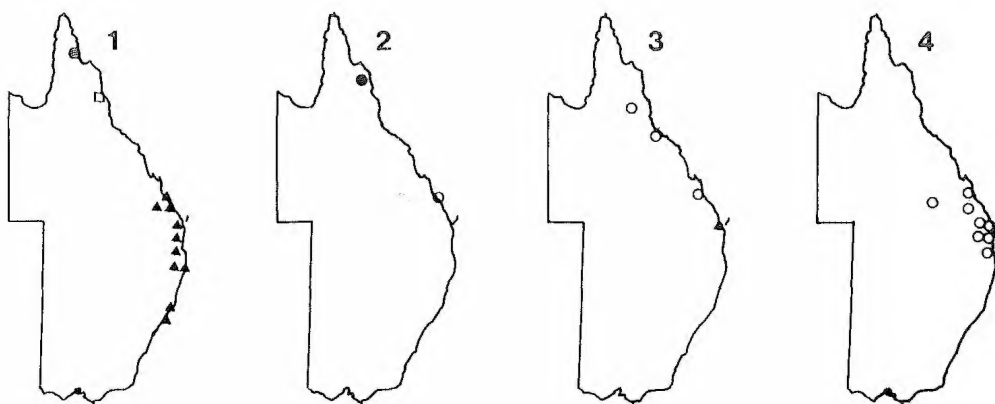
Two forms are present in Queensland as indicated above, and although they are now better represented in herbaria they are not formally recognised because they are connected by intermediates. Plants from north Queensland, viz Torres Strait islands, Weipa, Pascoe, Pennefather and Olive Rivers, have thin leaflets which are greenish or greyish green when dry and are finely nerved and reticulate-veined; their peduncles and calyces are very sparsely hairy, and fruits are smaller with a thin pericarp. Plants from southeast Queensland, viz Mt Eerwah, Mt Nebo, and near Gympie, have thicker, rigid leaflets which tend to dry somewhat yellowish, are prominently coarsely reticulate-veined, have denser hairs on peduncles and calyces, and have larger fruits with thicker pericarp. Plants from Magnetic Island and Fanning River, north Queensland, appear to be intermediate between these forms.

Jagera Blume

Jagera discolor L.S. Smith ex S. Reyn. and **J. dasyantha** (Radlk.) S. Reyn.

The relationship of these species and whether they are conspecific or not, has been investigated since 1985, when Dr van Welzen (pers. comm.) drew my attention to the similarities (especially in the flowers) of the type of *Guioa dasyantha* Radlk. with *Jagera discolor* specimens. He presumed these species to be conspecific (1990, p. 304).

The type of *Guioa dasyantha* Radlk. (flowering specimen from Sepik area, northern New Guinea) was examined. The flowers were that of a *Jagera* and not a *Guioa*, so the species is transferred to *Jagera* and a new combination *Jagera dasyantha* (Radlk.) S. Reyn. is thus made below.



Maps 1–5. Distribution of Sapindaceae spp. 1. *Rhysotoechia* spp.: *R. bifoliolata* subsp. *bifoliolata* ▲; *R. bifoliolata* subsp. *nitida* ●; *R. florulenta* □. 2. *Atalaya* spp.: *A. collina* ○; *A. oligoclada* ●. 3. *Atalaya calcicola* ○; *Cupaniopsis simulatus* ▲. 4. *Alectryon subdentatus* forma *pseudostipularis* ○. 5. *Jagera dasyantha*: New Guinea form ○; Queensland form △.

As indicated above, the type of *J. dasyantha* resembles *J. discolor* specimens especially those from New Guinea. It, however, differs from the type of *J. discolor* (from Clump Mountain, northern Queensland) in having more leaflets per leaf, narrower leaflets with a pronounced acumen at apex, slender peduncles and smaller flowers.

Plants from northern Queensland are typical of *J. discolor*, while most of the plants from New Guinea resemble the type of *J. dasyantha*, differing only slightly in the shape of leaflets and coarser hairs on the midrib of leaflets. Although no other collection of *J. dasyantha* from the type locality has been seen I am quite certain that all these New Guinea plants belong to the one taxon. A few specimens from New Guinea however approach *J. discolor* ones from Queensland, especially those from south New Guinea viz Owen's Corner, Kakoda Trail, N of Sogeri, Hartley 10765 (LAE); ditto, Schodde 2954 (LAE). These appear to be intermediate between typical *J. discolor* and typical *J. dasyantha* specimens.

Because of the presence of these intermediates and also because the specimens available for study are few and inadequate, I have after discussion with Dr Leenhouts (who has been revising *Jagera* (pers. comm. 1987)) decided to combine the two species and treat the taxa as belonging to one very variable species. *Jagera discolor* is therefore now reduced to synonymy under *Jagera dasyantha*, the earlier name.

***Jagera dasyantha* (Radlk.) S. Reyn. comb. nov.** *Guioa dasyantha* Radlk., Bot. Jarb. 56: 277 (1921). **Type:** Papua New Guinea. Sepik area, 1912–1913, Ledermann 10365 (iso: L.)

J. discolor L.S. Smith ex S. Reyn., Austrobaileya 1(5): 407, f. 28A (1981). **Type:** Queensland. COOK DISTRICT: Clump Mountain, 7 November 1951, L.S. Smith 4977 (holo: BRI).

This species is very variable with at least two forms being recognisable (as indicated above) but these forms are not formally named here because of the presence of intermediates.

New Guinea form: This occurs in northern New Guinea, New Britain and on Milne Bay Islands (Map 5). Leaves with 4–8 pairs of leaflets; petiole terete, trigonous at broad base; rachis terete; leaflets elliptic-ovate or obliquely oblong, apex long acuminate or caudate (acumen 10–20 mm long), or shortly acuminate or rarely obtuse; base obtuse, oblique, subequal; 2.4–4.5(–5.7) cm wide, upper surfaces glabrous or midribs hairy, lower ones finely appressed hairy; lateral nerves 5–12 pairs, strongly arched or $\pm$ oblique; reticulate venation often obscure above. Peduncles slender, 2.5–8 cm long; bracts minute, 0.5–1 mm long. Flowers 1.7–2 mm long; pedicels 2 mm long.

Note: The type has leaflets with long caudate tips (acumen to 20 mm long), strongly arcuate lateral nerves, and with midribs above glabrous. Most specimens have shorter acumen, midribs hairy above, and $\pm$ oblique or $\pm$ arcuate lateral nerves.

Queensland form: This form previously known as *J. discolor* occurs in northern Queensland (Map 5) (Reynolds 1981, p. 407). Leaves with 4 or 5 (or 6) pairs of leaflets; petioles subterete, broad and pulvinate at base; rachis subterete; leaflets elliptic or elliptic-ovate or -oblong; apex abruptly shortly acuminate (acumen less than 10 mm long) or obtuse; base usually broad unequal; (3–)4.8–5.7(–6.5) cm wide, glabrous above, lower surfaces finely appressed hairy; lateral nerves 8–12 pairs, $\pm$ oblique and ascending; reticulate venation prominent, usually forming a fine mesh. Peduncles 9–20 cm long, $\pm$ angular when dry; bracts prominent, 1–3(–5) mm long. Flowers to 2.5 mm long; pedicels 2–4 mm long.

Plants from Sogeri area, Western District, southern New Guinea, appear to be intermediate between the above forms.

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VARIATION IN *HOYA AUSTRALIS* R. BR. EX TRAILL (ASCLEPIADACEAE)

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Summary

Hoya australis R. Br. ex Traill is a highly variable taxon that occurs in Australia, Papuaia and Melanesia. Five subspecies are recognised within *H. australis*, defined by vegetative characters and floral phenology. *H. australis* subsp. *oramicola* is newly described and the new combinations *H. australis* subsp. *tenuipes* (*H. oligotricha* subsp. *tenuipes* K. Hill) and *H. australis* subsp. *rupicola* (*H. rupicola* K. Hill) are made.

Introduction

As noted by Liddle (1986) and Hill (1988), *H. australis* is an exceptionally variable taxon with a wide distribution in Australia, Papuaia and Melanesia. The recent account of the complex within Australia by Hill (1988) is deficient in several regards, firstly in that it does not recognise all of the variants that do occur, secondly in that it recognises 'variants' that do not occur, thirdly in the use of several characters primarily of indumentum that are of little use in taxon delimitation at the specific level, fourthly in the omission of several diagnostic characters that are obvious with live material and fifthly in the incorrect indication of the location of several types.

The *H. australis* complex encompasses a number of previously described taxa, namely *Gymnema recurvifolium* Blume, *Hoya dalrympleana* F. Muell., *H. bicarinata* Gray, *H. keysii* Bailey, *H. sanae* ("sana") Bailey, *H. papillantha* Schumann, *H. pubescens* Reinecke, *H. lactea* S. Moore, *H. oligotricha* K. Hill, *H. oligotricha* subsp. *tenuipes* K. Hill and *H. rupicola* K. Hill. These taxa exhibit a wide range of vegetative forms but are relatively uniform in terms of floral morphology. In this paper we attempt to reassess the wide variation in the group throughout its entire range and to define taxa based on discontinuities in morphology, ecological separation and phenological differentiation. As with other taxa of the genus, field observations and the study of live or pickled material is essential, as both floral and vegetative characters of these plants become considerably distorted and difficult to interpret once material is pressed and dried. Our taxonomic decisions are based on extensive field studies in Australia and the examination of a large number of plants of known origin under uniform conditions of cultivation.

Materials and Methods

Field studies in Queensland and the Northern Territory were undertaken by us from around 1978 onwards. A large number of plants from wild populations were cultivated both at Emerald Creek, Mareeba and Brisbane during this period.

Flowering material of these collections was pickled in 70% alcohol, glycerol and water and subsequently used for measurement of floral characters. Vegetative characters were determined from live plants that were flowering or that had previously flowered. It should be noted that since plants of this complex will only flower in bright light, measurements of vegetative characters were obtained from plants grown under these conditions. Plants grown in dense shade tend to have much thinner, larger leaves (cf. Adams *et al.* 1988, and our observations) and do not flower.

In the taxonomic section we have cited representative collections under the separate taxa, mainly to demonstrate the geographical distribution of each subspecies. For Australia these are collections that have been examined in the field, subsequently cultivated and represented, at least in BRI, both by dried and spirit material. A full list of collections seen is given in **Appendix 1**. The maps show Australian distributions only, as we have not seen comprehensive herbarium material of these plants from Papuaia and Melanesia, nor have we conducted field studies in these regions.

The following characters were measured on 142 clones of known wild origin. The number of samples for each clone is indicated in [] brackets.

(1) habit: (a) twining, (b) erect or scrambling but not twining. [1].

(2) leaf type: (a) very succulent, (b) fleshy to succulent (c) coriaceous. [1].

Note: "very succulent" denotes leaf thickness of 2.5–3.5 mm, "fleshy to succulent" denotes leaf thickness of 1.2–1.6 mm; coriaceous denotes leaf thickness < 1.2 mm (cf. Forster 1990b).

(3) leaf margin: (a) not recurved, (b) strongly recurved. [1].

(4) leaf venation: (a) prominent, (b) obscure. [1].

(5) indumentum: (a) absent, (b) scattered, (c) sparse (d) dense. [10].

Note: Hill (1988) placed much emphasis on the orientation of indumentum in definition of taxa in the group. We observed that this could be variable both within and between populations and have not used it as a character. Indumentum cover is defined using the system developed by Hewson (1988), except that we use the term 'scattered' instead of 'isolated'.

(6) extrafloral nectaries on lamina: (a) present, (b) absent. [10].

(7) lamina length and width. [10].

(8) flower diameter. [5].

(9) pedicel length and width. [5].

(10) sepal length and width. [5].

(11) corolla lobe length and width. [5].

(12) staminal corona diameter. [5].

(13) individual staminal corona lobe length. [5].

(14) individual staminal corona lobe width. [5].

(15) length of slit between anther wing. [5].

(16) pollinium length and width. [5].

(17) corpusculum length and width. [5].

(18) caudicle length and width. [5].

Where possible 5 flowers from the same inflorescence were scored separately for characters 8–18, but where less than 5 flowers were present, scoring was increased on individual flowers.

Results

Plants could be consistently allocated to one of five groups on a number of characters of habit and leaf morphology. These characters are summarised in Table 1.

Table 1. Allocation of clones of *H. australis* complex into 5 groups on the basis of plant habit and leaf morphology characters that exhibit variation

Character	Group				
	1	2	3	4	5
(1) habit: (a) twining, (b) erect or scrambling, but not twining	a	a	b	a	a
(2) leaf type: (a) very succulent (b) fleshy to succulent, (c) coriaceous	b	c	a	b	b
(3) leaf margin: (a) not recurved, (b) strongly recurved	a	a	a	b	b
(4) leaf venation: (a) prominent (b) obscure	b	b	b	a	b
(5) extrafloral nectaries on lamina: (a) present, (b) absent	a	a	b	ab	b

Plants could not be consistently allocated into groups on the basis of lamina indumentum cover, lamina length and width or the ratio of the latter two. Plants of groups 3 and 4 (Table 1) tend to have dense indumentum on both lamina surfaces, but particularly on the adaxial surface. Plants of group 1 tend to have sparse to dense indumentum, often on both lamina surfaces, but also quite commonly only on the adaxial surface. Plants of group 2 are glabrous or have scattered to sparse indumentum on the lamina surfaces. Leaf length and width varies considerably across all groups, although there was a slight tendency for plants of group 3 to have more lanceolate leaves than those of the other groups (Fig. 1).

Flower shape was consistent throughout the clones examined. The number of flowers per inflorescence and pedicel length appeared to be dependent on individual growing conditions and could vary from inflorescence to inflorescence or from year to year on the same plant. Flower size was extremely variable with most noticeable variation being in the corolla lobe length and width (Fig. 2) and pollinium length and width (Fig. 3). Very small flowers tended to have small coronas and small pollinaria, whereas very large flowers tended to have large coronas and large pollinaria. There was continuous variation in all floral characters between all groups defined on vegetative characters.

Plants of the five groups defined on habit and leaf morphology (Table 1) tend to have, but not exclusively so, discrete flowering periods in Australia (Group 1: March–May; Group 2: September–October, rarely March–May; Groups 3 & 5: January–March; Group 4: May–July) and also occur in different habitat types. Plants of groups 1 and 2 occur over much the same geographical range in north Queensland but are always ecologically discrete, although at times the physical distance between them may be small. Plants of groups 1 and 4 are generally found in different areas, but both occur in close proximity in the Glennie Tableland area on Cape York Peninsula.

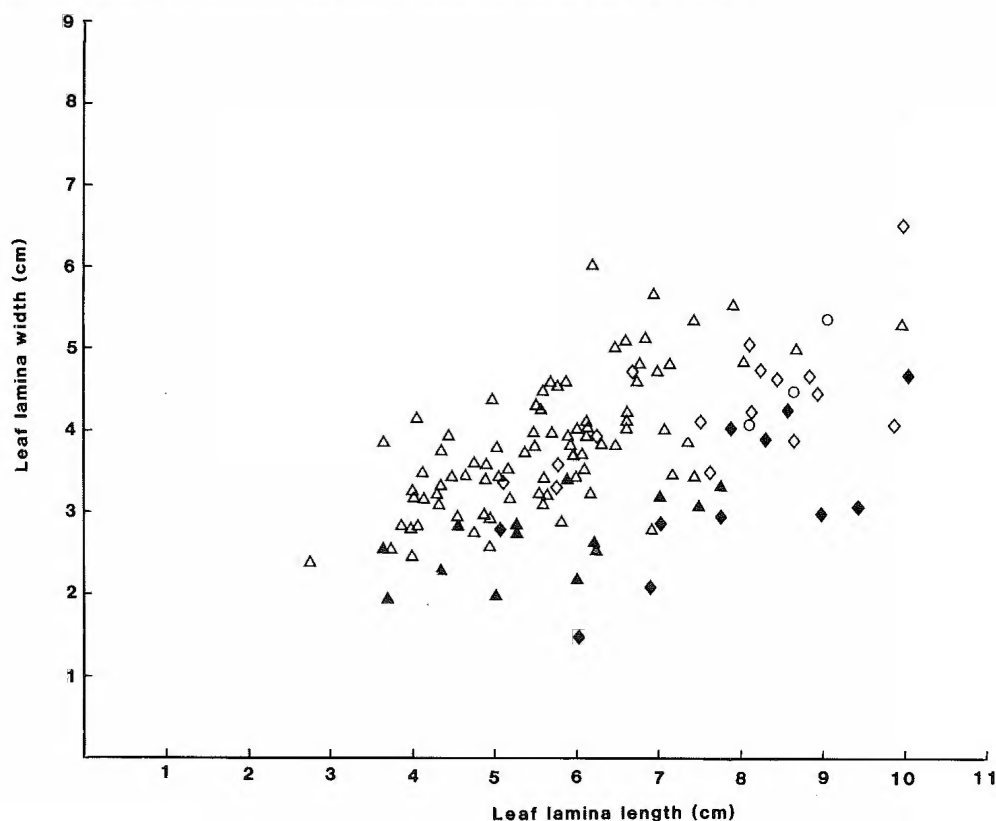


Fig. 1. Leaf lamina length versus leaf lamina width in *Hoya australis*. $\triangle$ Group 1 (subsp. *australis*); $\blacktriangle$ Group 2 (subsp. *sanae*); $\blacklozenge$ Group 3 (subsp. *rupicola*); $\diamond$ Group 4 (subsp. *tenuipes*); $\circ$ Group 5 (subsp. *oramicola*).

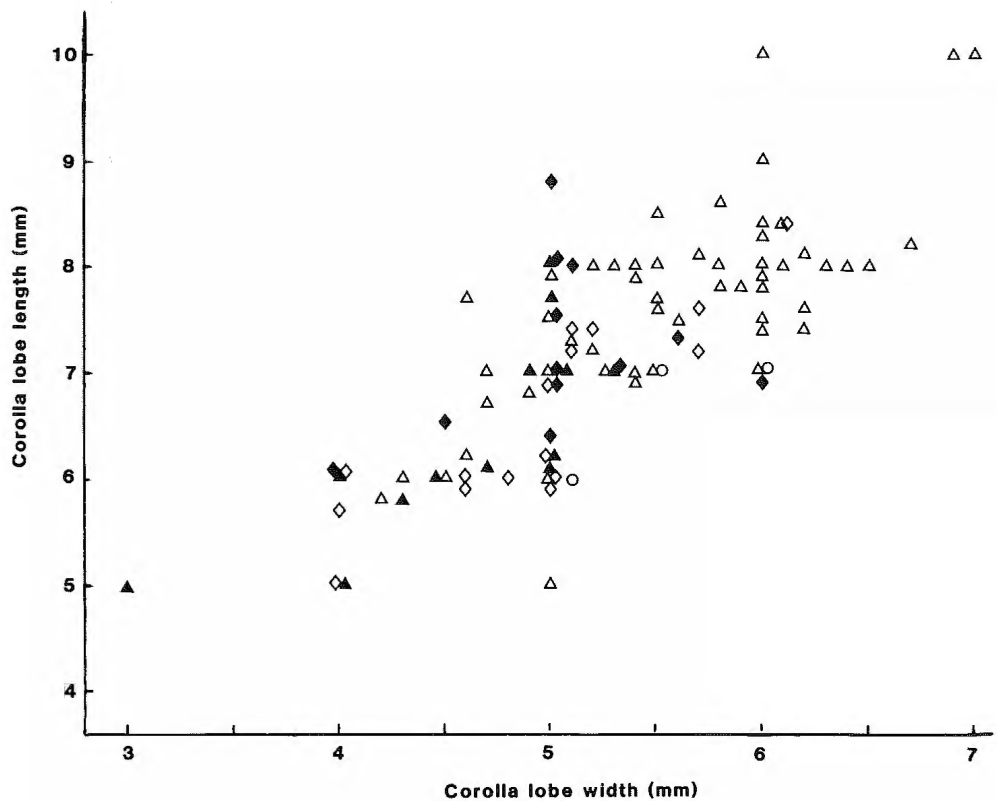


Fig. 2. Corolla lobe length versus corolla lobe width in *Hoya australis*. $\triangle$ Group 1 (subsp. *australis*); $\blacktriangle$ Group 2 (subsp. *sanae*); $\blacklozenge$ Group 3 (subsp. *rupicola*); $\diamond$ Group 4 (subsp. *tenuipes*); $\circ$ Group 5 (subsp. *oramicola*).

Discussion

In the genus *Hoya* (Forster & Liddle 1990; Rintz 1978) and elsewhere in the family Asclepiadaceae, species have been defined primarily on discontinuities in floral characters. Vegetative characters provide useful secondary data for specific delimitation or for defining groups of species. However, no study (including the present) has ever really addressed the relative worth of floral characters as opposed to purely vegetative ones for taxon delimitation. Certainly, in terms of the breeding biology of species of *Hoya*, there are some obvious barriers to the insertion of pollinia of a given taxon into the slit between the anther wings of taxa with markedly different flowers. In other cases this is less so. Given our lack of knowledge of the breeding biology of the group, we feel it is prudent to retain the concept of floral discontinuity in defining species and reject Hill's (1988) definition of species on indumentum orientation and geographic origin.

Hence, we consider that the five groups we have defined in the *H. australis* complex are best treated as subspecies of the one species because there is no discontinuity in floral morphology but a marked discontinuity in vegetative morphology. For the taxa so defined, there are also both ecological and geographical separations.

The trend of increasing leaf succulence in plants of the *H. australis* complex is a result of greater development of mesophyll tissue in the leaf (Forster 1990b). This trend may be interpreted as representing an increasing adaptation to seasonal water deficit with a presumed radiation of plants of the complex out of an ancestral rainforest habitat (subsp. *tenuipes*) into ever drier habitats with the extreme being the sandstone escarpments

of Arnhem Land and the Kimberley (subsp. *rupicola*). The possession of succulent leaves and the ability of plants of *H. australis* to tolerate a wide range of light conditions (Adams *et al.* 1988, cf. subsp. *australis* only) enable plants of this complex to occur in a range of different habitats over a wide geographic range in Australia, Papuaia and Melanesia.

The earliest specific name applicable to the group is *Hoya australis* R. Br. ex Traill, and the five groups defined in Table 1 equate to the following taxa based on our examination either of type collections or descriptions from the literature.

Group 1: *Hoya australis* R. Br. ex Traill; *Hoya dalrympleana* F. Muell.; *Hoya keysii* Bailey; *Hoya pubescens* Reinecke; *Hoya oligotricha* K. Hill subsp. *oligotricha*.

Group 2: *Gymnema recurvifolium* Blume; *Hoya bicarinata* A. Gray; *Hoya papillantha* Schumann; *Hoya lactea* S. Moore; *Hoya oligotricha* subsp. *tenuipes* K. Hill.

Group 3: *Hoya rupicola* K. Hill.

Group 4: *Hoya sanae* Bailey; *Hoya australis* subsp. *sanae* (Bailey) K. Hill.

Group 5: Undescribed taxon.

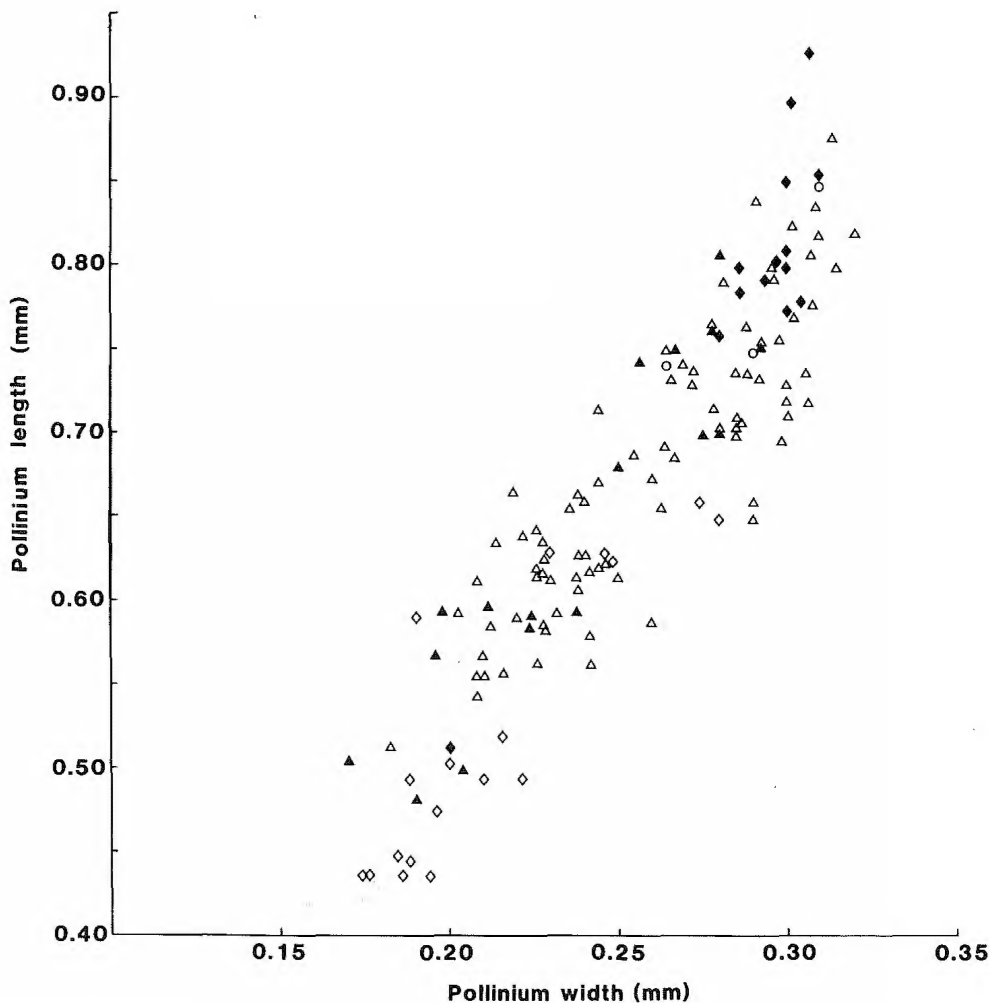


Fig. 3. Pollinium length versus pollinium width in *Hoya australis*. $\triangle$ Group 1 (subsp. *australis*); $\blacktriangle$ Group 2 (subsp. *sanae*); $\blacklozenge$ Group 3 (subsp. *rupicola*); $\diamond$ Group 4 (subsp. *tenuipes*); $\circ$ Group 5 (subsp. *oramicola*).

Taxonomic Treatment

Hoya australis R.Br. ex Traill, Trans. Hort. Soc. 7: 28 (1830). **Type:** Queensland. COOK DISTRICT: Cape Grafton, [1770] *Banks & Solander* (holo: BM!).

Succulent vine to subshrub. Stems cylindrical, succulent becoming somewhat woody with age; twining or clambering, glabrous or with indumentum when young. Leaves petiolate; lamina succulent, fleshy to coriaceous, elliptic, narrow-ovate, oblong, ovate or orbicular, up to 15 cm long and 12 cm wide, glabrous or with indumentum; tip acuminate, acute or apiculate; base rounded, cordate, obtuse or cuneate; petiole up to 2 cm long; extrafloral nectaries absent or present at lamina base. Cymes racemiform, persistent, with up to 50 flowers; peduncles 1–3 cm long, glabrous or with indumentum. Flowers campanulate 3–5 mm long, 10–25 mm diameter; pedicels 2–4 cm long. Sepals ovate to triangular, 1–5 mm long, 1–3 mm wide, with sparse to dense indumentum and with 1 to several glands at base. Corolla minutely puberulous, white to cream with red under staminal corona; lobes ovate to acute, 5–10 mm long, 3–7 mm wide, apex antrorse, margins revolute. Staminal corona cream; lobes 1.2–3.5 mm long, 1–2.5 mm wide, ovate, concave above, with two longitudinal inrolled keels. Slit between anther wings 0.7–1.2 mm long. Style-head conical, 1–1.5 mm diameter. Ovaries 1.6–2 mm long, 1.4–1.5 mm wide, glabrous. Pollinarium 0.9–1.15 mm long, 0.5–0.8 mm wide; pollinium oblong, 0.56–0.92 mm long, 0.22–0.41 mm wide; corpusculum ovate-oblong, 0.3–0.45 mm long, 0.15–0.24 mm wide; caudicles unwinged, 0.15–0.34 mm long, 0.05–0.14 mm wide. Follicles fusiform 9–13.5 cm long, 1–1.5 cm wide. Seed oblong, tan, 5–7 mm long, 2–3 mm wide; coma 25–30 mm long.

Key to subspecies, based on live or pickled material

1. Margin of leaf lamina strongly recurved 2
 Margin of leaf lamina not recurved 3
2. Leaf lamina <5 cm long, secondary venation prominent subsp. *sanae*
 Leaf lamina >5 cm long, secondary venation obscure subsp. *oramicola*
3. Plant erect, not twining; leaf lamina very succulent, lacking extrafloral
 nectaries at base subsp. *rupicola*
 Plant twining; leaf lamina coriaceous, fleshy or succulent, with extrafloral
 nectaries at base 4
4. Foliage with sparse to dense indumentum; leaf lamina fleshy or
 succulent subsp. *australis*
 Foliage glabrous or with sparse indumentum; leaf lamina
 coriaceous subsp. *tenuipes*

1. **Hoya australis** R. Br. ex Traill subsp. **australis**

Hoya dalrympleana F. Muell., Rep. Burdekin Exped. 16 (1861). **Type:** Queensland. NORTH KENNEDY DISTRICT: On granite hills at Cape Cleveland, *E. Fitzalan* (holo: *n.v.*).

Hoya pilosa Seem., Bonplandia 9: 257 (1861), *nom. nud.* (*fide* A.C. Smith, Fl. Fiji 4: 118 (1988)).

Hoya keysii Bailey, Proc. Roy. Soc. Queensland 1: 87 (1884). **Type:** Queensland. BURNETT DISTRICT: Mount Perry, climbing over rocks, *J. Keys* (holo: BM *n.v.*, photo at BRI).

Hoya pubescens Reinecke, Bot. Jahrb. Syst. 23: 669 (1898). **Type:** Samoa. Upolu, Apia, Jan 1894, *Reinecke* 220 (holo: B†; iso: BISH!).

Hoya oligotricha K. Hill, Telopea 3: 253 (1988), **synon. nov.** **Type:** Queensland. COOK DISTRICT: Davies Ck, E of Mareeba, *D. Liddle* (holo: NSW *n.v.*; iso: L *n.v.*, BRI, K not received).

Illustrations: Bailey, Compr. cat. Queensland pl. t. 309, 310 (1913); Jones & Gray, Aust. Climbing Pl. t. 118, 119, 120 (1977); Williams, Native Pl. Queensland 1: 160 (1979); Liddle, Hoya in Australia Fig. 5 (1986); Hill, Telopea 3: 245 (1988).

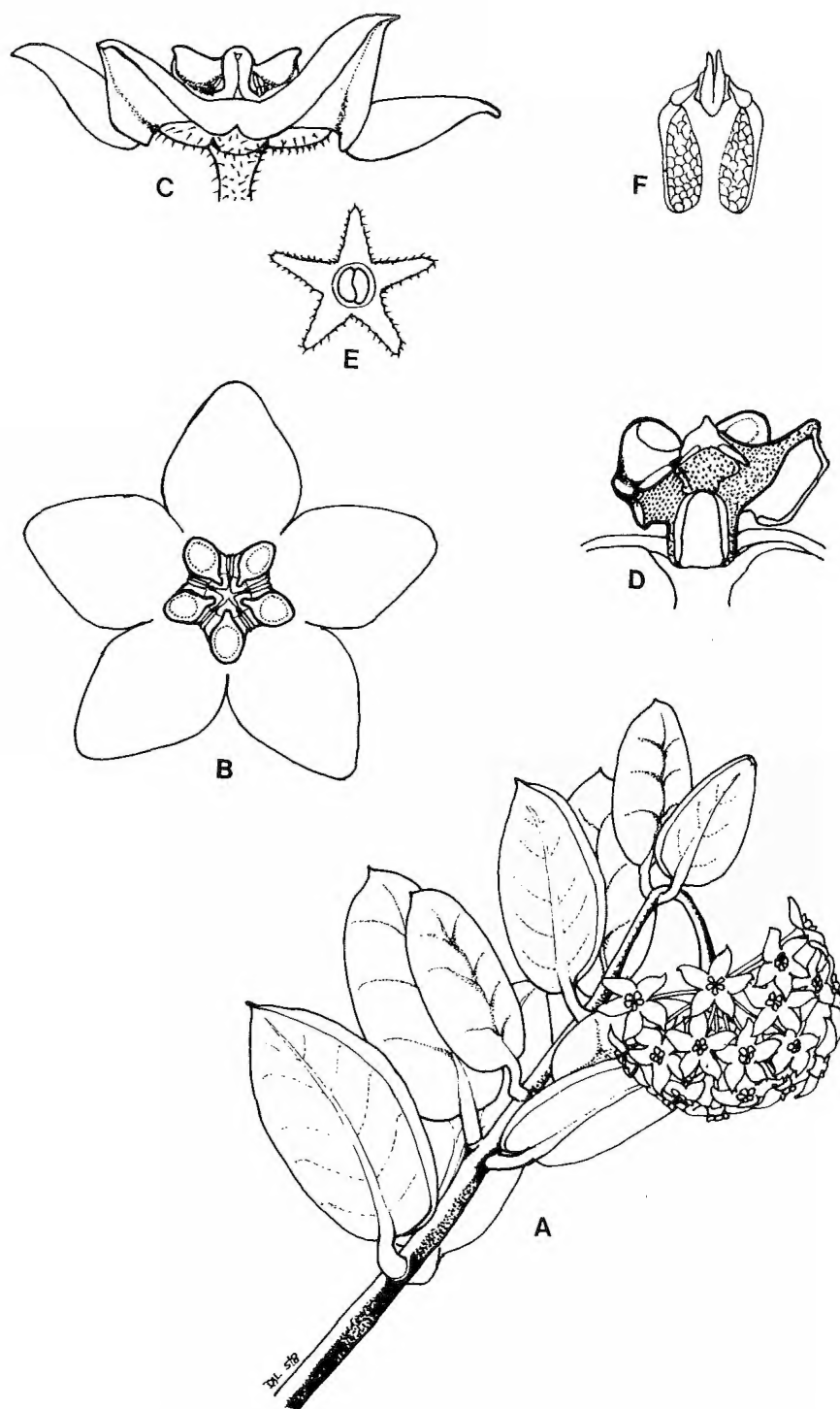


Fig. 4. *Hoya australis* subsp. *australis*: A. habit of flowering plant $\times 0.5$. B. apical view of flower $\times 3$. C. side view of flower $\times 3$. D. vertical cross-section of flower $\times 6$. E. calyx and ovaries from above $\times 6$. F. pollinarium (inverted) $\times 20$. A–F, Liddle IML599. Del. D.J. Liddle.

Vine or rarely a twining subshrub. Foliage with sparse to dense indumentum. Leaf lamina fleshy to succulent, with extrafloral nectaries at base; margins not strongly recurved; secondary venation obscure. Fig. 4.

Selected specimens: Australia. Queensland. COOK DISTRICT: Nagir Is, 10°30'S, 142°30'E, Oct 1983, *Liddle* IML288 (BRI); cult. Emerald Ck (ex plant collected Head of Hann Ck, 12°28'S, 142°59'E), Apr 1988, *Lavarack* IML528 (BRI); T.R. 14, Rocky River, 13°50'S, 143°25'E, Sep 1973, *Hyland* 6807 (QRS); Silver Plains, 13°06'S, 143°22'E, Jul 1982, *Liddle* IML208 (BRI); Cape Grafton, 16°52'S, 145°55'E, Jun 1986, *Watts* IML606 (BRI); Davies Ck, 17°03'S, 145°35'E, Apr 1980, *Liddle* IML5 (BRI, MEL, QRS). NORTH KENNEDY DISTRICT: cult. Indooroopilly (ex plant collected by R. Lockyer, 1 mile W of Ravenshoe, Bald Rock Trig Stn, 17°36'S, 145°27'E, Feb. 1986), *Forster* 2383 (BRI). SOUTH KENNEDY DISTRICT: Bailey Islet, May 1969, *Firth* [AQ 007897] (BRI). LEICHHARDT DISTRICT: Rainbow Falls, Blackdown Tableland N.P., 23°51'S, 149°06'E, May 1984, *Forster* 1785 (BRI). PORT CURTIS DISTRICT: Mt Hedlow, 27.5 km N of Rockhampton, 23°07'S, 150°35'E, May 1984, *Forster* 1805 (BRI). BURNETT DISTRICT: 2 km SW of Boolbunda Rock, 25°08'S, 151°41'E, May 1986, *Forster* 2424 (BRI); Mt Lorna, "Toondahra", 42 km SSE of Mundubbera, 25°29'S, 151°21'E, Mar 1984, *Forster* 1755 (BRI). WIDE BAY DISTRICT: Black Gin Ck, T.R. 580, 25°29'S, 151°55'E, May 1987, *Forster* 2906 (BRI). MORETON DISTRICT: Flinton Hill, Worlds End Pocket, Brisbane River, 27°31'S, 152°45'E, Mar 1983, *Forster* 1843 (BRI); Ivorys Rock, 17 km S of Ipswich, 27°46'S, 152°47'E, Aug 1984, *Forster* 1871, *Bostock & Bird* (BRI, MEL). New South Wales. cult. Indooroopilly (ex plant collected by N. Skennar from Glenugie Peak, 29°50'S, 152°56'E), Jul 1985, *Forster* 2036 (BRI). Vanuatu. Malekula, Tisbel, Sep 1971, *Halle* RSNH6330 (P); Piste de Bunlap, Apr 1977, *Morat* 5489 (P); Aneityum Is, Vtgi, Mar 1939, *Wilson* 1002 (P).

Distribution and habitat: This subspecies occurs in eastern Australia (Map A) from Torres Strait south to northern New South Wales and is also in Melanesia (cf. type of *H. pubescens* Reinecke, pubescent forms discussed by Smith (1988) and specimens cited). Plants grow on rock outcrops or cliffs in open eucalypt forest or heath in northern Queensland and in vinethickets and vineforests in southern Queensland, New South Wales and Melanesia. Plants growing on the mainland of Cape York Peninsula north of 12°28'S are mostly subsp. *sanae* (Bailey) K. Hill.

Phenology: Australian populations flower from March to May and fruit 3–4 months later.

Notes: As noted by Henderson (1983), *H. australis* had a rather informal entry into the taxonomic literature, with the result that the correct author citation and place of publication has often been confused, particularly in the horticultural literature. Brown (1810) listed Australian material of *Hoya* under *H. carnosa* which is an Asian species, with the comment that the material could well be specifically distinct. In the Prodrum, Brown listed the locality for Australian *Hoya* as (T) and said that he had seen plants of it living (v.v.), thus indicating that material he worked with was collected by him somewhere on the coast of Queensland and the Northern Territory westward to Arnhem Bay (Stearn 1960). The first effective publication of *H. australis* is that of Traill (1830) who stated "The first is a native of the more northern part of New South Wales, with leaves varying from elliptic to obovate; this is in the Herbarium of Mr. Robert Brown, and is named by him *Hoya australis*, it having been referred by him in his Prodrum Flora Novae Hollandiae, Vol. i. page 460, with a doubt, to *H. carnosa*."

No material of *H. australis* exists at BM that was collected by Brown. A Banks and Solander collection from Cape Grafton near Cairns is present in BM and is the material illustrated in Banks and Solander (1901). There are two sheets of this, one (the poorer) which was taken by Brown on the voyage with Flinders, and the other which has written in Brown's handwriting – *H. australis*. This latter sheet is undoubtedly that seen by Traill and is the type of *H. australis*. Brown's omission of "B" from the relevant text in the Prodrum, indicating use of Banks and Solander material (Burbidge 1955; Stearn 1960) is apparently an error.

Recollection of material both at Cape Grafton and adjoining areas revealed plants with variable leaf form, but all consistently with small (<10 cm long and 5 cm wide), orbicular, densely pubescent succulent leaves. *Watts* IML600 from Rocky Island off Cape Grafton, in particular is similar to that illustrated by Banks and Solander (1901).

We have been unable to locate the type of *H. dalrympleana* which is apparently not at MEL (H. Aston, pers. comm. 1990) as thought by Hill (1988). We have included it within the synonymy of *H. australis* subsp. *australis* as neither subsp. *tenuipes* nor subsp. *sanae* occurs as far south as Townsville.

The isotype of *H. pubescens* at BISH is poor but both the stems and petioles have a sparse to dense indumentum. As outlined by Smith (1988), such pubescent plants are

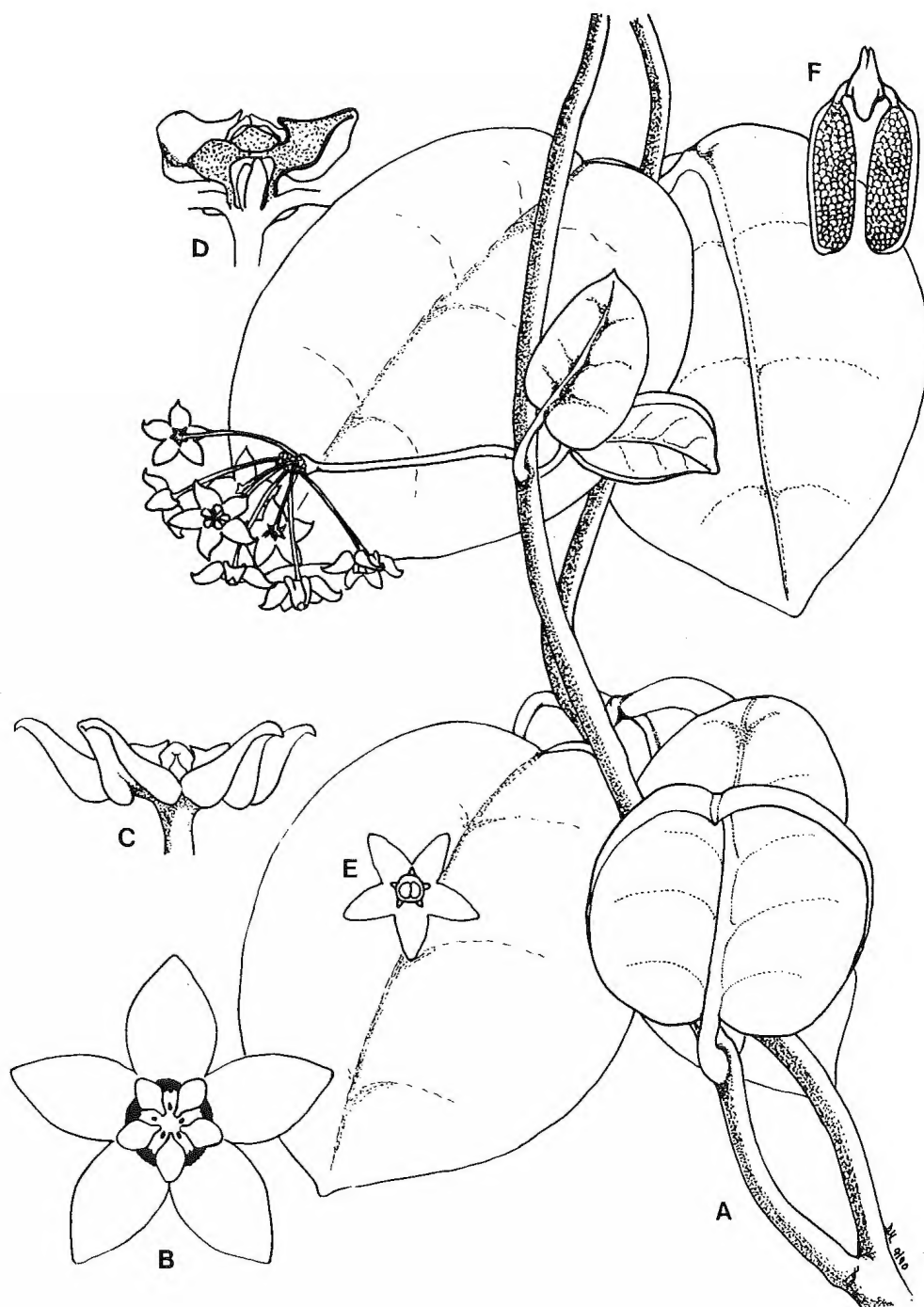


Fig. 5. *Hoya australis* subsp. *tenuipes*: A. habit of flowering plant $\times 0.5$. B. apical view of flower $\times 2.5$. C. side view of flower $\times 2.5$. D. vertical cross-section of flower $\times 5$. E. calyx and ovaries from above $\times 2.5$. F. pollinarium (inverted) $\times 25$. A-F, Liddle IML1. Del. D.J. Liddle.

relatively common in parts of Melanesia and from the specimens we have examined, this subspecies occurs both in Samoa and Vanuatu.

The type of *H. keysii* is not at BRI as was previously thought (Hill 1988: 250), but at BM (Forster 1989). This is an unusual location for an F.M. Bailey holotype; BM should be considered when seeking location of missing types relative to other taxa described by him. Small densely pubescent, orbicular-leaved plants that are more or less identical with the type of *H. keysii* were relocated at Boolbunda Rock near Mt Perry (Forster 2424). These plants are very similar to those from Cape Grafton.

Plants at Davies Creek, the type locality of *H. oligotricha*, are virtually indistinguishable from the Cape Grafton plants, so the recognition of *H. oligotricha* in addition to *H. australis* by Hill (1988) is unnecessary. One of us originally collected the material at Davies Ck from which Hill purportedly prepared his type material, however we have not seen the resultant herbarium specimens and this type material does not appear to have been distributed, at least to BRI and K. In addition to the type collection of *H. oligotricha*, Hill cites a different collection from Davies Creek for *H. australis sensu* Hill. Both of these collections are referable to *H. australis* subsp. *australis*. Apart from indumentum development on the lamina, the main criterion by which *H. oligotricha* subsp. *oligotricha* is distinguished by Hill from *H. australis* subsp. *australis*, is that in southern Queensland it is a coastal plant whereas the other species is "restricted to the ranges". While we do not wish to belabour this misconception, many populations can be found where there is no distinction. As examples, *Kenning* IML566 from Lake Bowraddy on Fraser Island ("a coastal sand habitat") is quite pubescent, and *Forster* 4275 from the top of Mt Perry ("the ranges") is almost glabrous.

Conservation status: This is a very common plant and is not endangered. Plants are widely cultivated under a variety of names, sometimes even correctly as *H. australis*!

2. *Hoya australis* subsp. *tenuipes* (K. Hill) P. Forster & D. Liddle, **comb. nov.** *Hoya oligotricha* subsp. *tenuipes* K. Hill, *Telopea* 3: 254 (1988). **Type:** Queensland, COOK DISTRICT: Pascoe River Rockpile, 16 September 1978, *B. Wallace* 83252 (holo: NSW *n.v.*; iso: L *n.v.*; BRI, K not received).

Gymnema recurvifolium Blume, *Mus. Bot.* 1: 150 (1850), **synon. nov.** **Type:** Nov. Guinea, *Zippelius* (holo: [L898168-39, L898168-41] L!).

Hoya bicarinata A. Gray, *Proc. Am. Acad. Arts Sc.* 5: 335 (1862). **Type:** Tonga, Tongatapu, *U.S. Expl. Exped.* [US78372] (lecto: US!; *fide* A.C. Smith, *Fl. Fiji* 4: 118 (1988)).

Hoya barrackii Horne, *A Year in Fiji* (1881), *nom. nud.* (*fide* A.C. Smith, *Fl. Fiji* 4: 118 (1988)).

Hoya papillantha Schumann, *Notizbl. Bot. Gart. Mus. Berl.* 2: 142 (1898), **synon. nov.** **Type:** "Neu-Lanenburg-Gruppe, Credner-Insel, an einem Stamme von subcordata", Jul 1896, *Dahl* 239 (holo: B†).

Hoya lactea S. Moore, *J. Bot.* 52: 293 (1911), **synon. nov.** **Type:** Papua New Guinea, CENTRAL PROVINCE: Mt Gandada, *H.O. Forbes* 872 (syn: BM *n.v.*, photo at BRI!); without locality, *H.O. Forbes* 925 (syn: BM *n.v.*).

Illustration: Liddle, *Hoya in Australia* Figs 10 & 11 (1986).

Vine. Foliage glabrous or with scattered to sparse indumentum. Leaf lamina coriaceous, with extrafloral nectaries at base; margins not strongly recurved; secondary venation obscure. **Fig. 5.**

Selected specimens: Irian Jaya. Warnapi, 15 km N of Ransiki, Vogelkop, Sep 1948, *Kostermans* 2715 (L); Cycloop Mtns, road Hollandia - Sentani, Jun 1961, *van Royen & Sleumer* 5715 (BRI, L). Papua New Guinea. MADANG PROVINCE: Josephstaal, 4°45'S, 145°00'E, Sep 1958, *White* [NGF10323] (A, BRI, CANB). NEW BRITAIN: Bei Massawa, Nov 1901, *Schlechter* 13707 (WRS). BOUGAINVILLE: Arawa Plantation, 6°15'S, 155°40'E, Dec 1960, *Millar* [NGF38401] (BRI, CANB, L). SOUTHERN HIGHLANDS PROVINCE: Near Moro, Lake Kutubu, 6°22'S, 143°14'E, Oct 1961, *Schodde* 2445 (A, CANB, L). MOROBE PROVINCE: track to Mt Shungol, 6°30'S, 146°45'E, Nov 1970, *Stevens* [LAE50489] (A, BRI, CANB, L). NORTHERN PROVINCE: Near Ridubidubina camp, Aug 1954, *Hoogland* 4509 (A, L). WESTERN PROVINCE: Daru Is, 9°07'S, 143°20'E, Aug 1967, *Ridsdale* [NGF33759] (L). CENTRAL PROVINCE: Boridi, Nov 1935, *Carr* 13467 (CANB, L). MILNE BAY PROVINCE: Biniguni, Mayu I track, 9°38'S, 149°18'E, Jun 1972, *Streimann & Leach* [NGF28579] (BRI, CANB). Solomon Islands. San Cristobal, mouth of Muni River, Aug 1965, *Sore* 2331 (A, L). Australia. Queensland. COOK DISTRICT: Mulingar, McIlwraith Range, Apr 1979, *Liddle* IML25 (BRI); Lankelly Ck, 13°53'S, 143°18'E, Apr 1979, *Liddle* IML26, IML27 (BRI); Daintree Barge, 16°17'S, 145°24'E, Aug 1979, *Liddle* IML3 (BRI); Atherton, 16°34'S, 145°40'E, Apr 1978, *Liddle* IML1 (BRI). NORTH

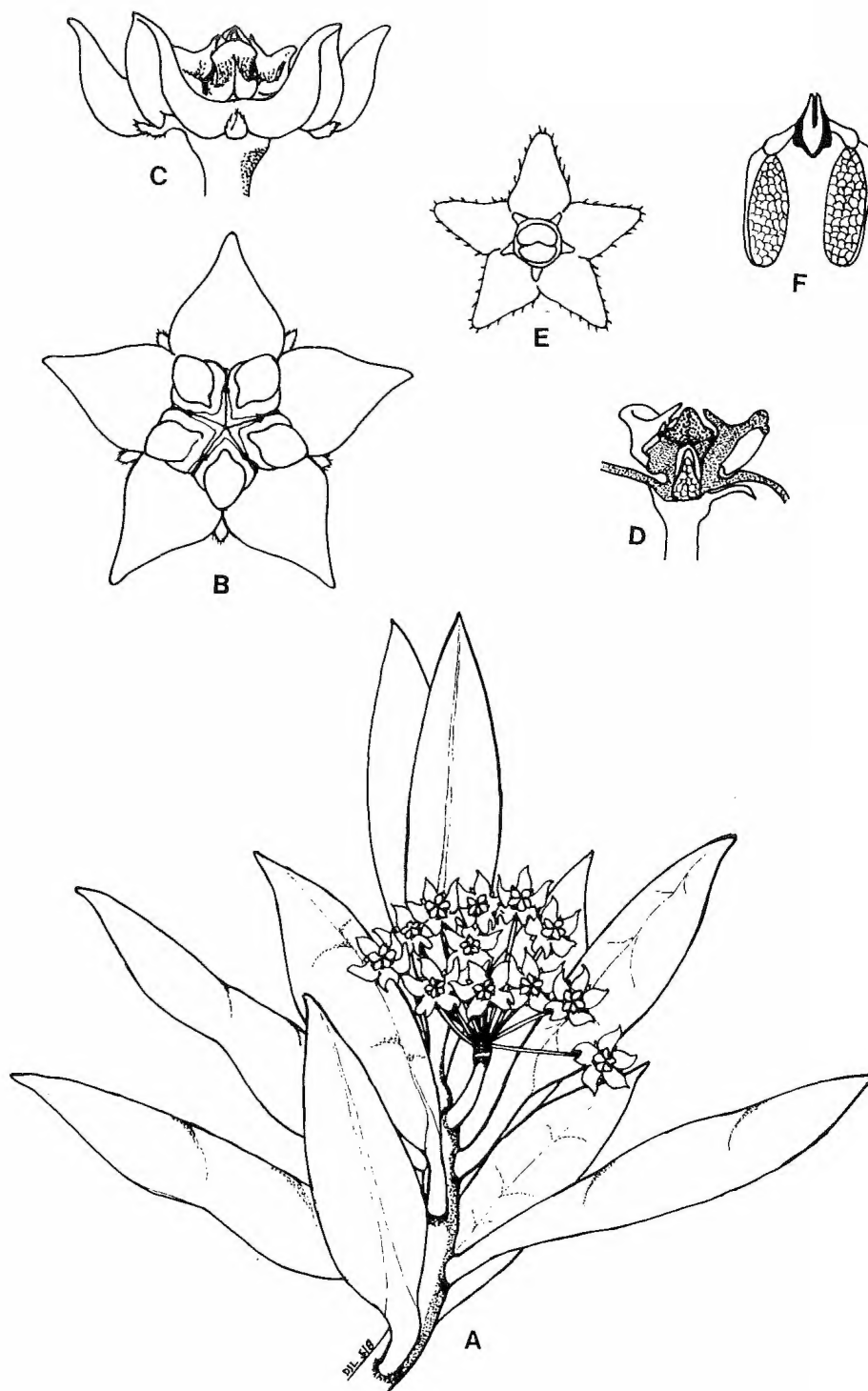


Fig. 6. *Hoya australis* subsp. *rupicola*: A. habit of flowering plant $\times 0.5$. B. apical view of flower $\times 3$. C. side view of flower $\times 3$. D. vertical cross-section of flower $\times 3$. E. apical view of calyx and ovaries $\times 3$. F. pollinarium (inverted) $\times 20$. A-F, Liddle IML758. Del. D.J. Liddle.

KENNEDY DISTRICT: cult. Indooroopilly (ex plant collected by R. Lockyer at Charmillan Ck, c. 12 km SSW of Ravenshoe, 17°42'S, 145°31'E, Feb 1986), *Forster* 2380 (BRI). New Caledonia. Paita, Mont Lulu, Ile Wallis, Dec 1981, *McKee* 40077 (P). Fiji. Vitu Levu, Sep 1947, *Smith* 6256 (BRI); cult. Indooroopilly (ex plant collected by P. Spence on Mana Is), Apr 1986, *Forster* 2394 (BRI).

Distribution and habitat: This subspecies occurs in Queensland (**Map B**) on southern Cape York Peninsula south to Innisfail and also in New Guinea, the Solomon Islands and Melanesia. Plants grow in rainforests, vineforests or adjacent to mangroves either as epiphytes or lithophytes.

Phenology: In Australia, the main flowering period is from September to October, although there may be a few flowers present in April or May; fruits appear 3–4 months later.

Notes: The most distinctive features of this subspecies are the more or less glabrous, coriaceous to fleshy foliage, and the slender peduncles. Both characters were recognised by Hill so that our concept of this taxon is similar to his. We consider the taxon also occurs in New Guinea and Melanesia where it has been previously described several times at the specific level. An excellent account of the taxa of this complex of *Hoyas* described from Melanesia including notes on typification, nomenclature and indumentum development, is given by Smith (1988). In this, subspecies *tenuipes* appears to be the most frequently collected taxon in that region.

The type collection of *Gymnema recurvifolium* which comprises two sheets, has inflorescences with only very young buds present. Dissection of some of those buds was not particularly informative as to the generic placement of the material as neither the staminal column nor pollinaria were developed. On the basis of the foliage and racemiform, persistent peduncles this material does not belong to *Gymnema* (soon to be included in *Marsdenia* R. Br. or *Stephanotis* Thouars (cf. *Forster* 1990a)) and is not referable to any taxon of *Marsdenia* s.l. that occurs in Papuasia (*Forster* unpubl.). This material is, however, an excellent vegetative match for other collections of *H. australis* subsp. *tenuipes* from Papuasia so we are confident on the inclusion of Blume's taxon within this subspecies.

The lectotype of *H. bicarinata* at US is rather fragmentary. It has glabrous upper leaf surfaces and on the lower leaf surface is glabrous except for scattered indumentum on the midrib.

The type of *H. papillantha* is not extant. However, we have been able to locate a specimen (*Schlechter* 13707) subsequently cited under this name by *Schlechter* (1905) who compared his material with the type in B. This collection is glabrous and typical of the coriaceous large-leaved plants that have been collected from New Britain, Bougainville and the Solomon Islands.

Conservation status: This subspecies is commonly encountered and is not endangered. Plants are widely cultivated.

3. *Hoya australis* subsp. *rupicola* (K. Hill) P. Forster & D. Liddle, comb. et stat. nov.
Hoya rupicola K. Hill, *Telopea* 3: 252 (1988). **Type:** Northern Territory. Deaf Adder Gorge, 24 February 1977, *R.E. Fox* 2548 (holo: NSW *n.v.*; iso: CANB, DNA!).

Subshrub or trailer, not climbing. Foliage with dense indumentum. Leaf lamina very succulent, lacking extrafloral nectaries at base; margins not strongly recurved; secondary venation obscure. **Fig. 6.**

Selected specimens: Western Australia. Surveyors Pool, Mitchell Plateau, 14°41'S, 125°43'E, Jun 1976, *Kenneally* 5075 (PERTH); Camp Ck, Mitchell Plateau, 14°53'S, 125°44'E, Jan 1982, *Kenneally* 7788 (PERTH); Summit of Mt Trafalgar, Prince Regent River Reserve, 15°17'S, 125°04'E, Aug 1974, *George* 12800 (PERTH); Fern Gully, Garipeli Ck, Prince Regent River Reserve, 15°32'S, 125°13'E, Aug 1974, *George* 12639 (BRI, PERTH). Northern Territory. Wessel Is., 11°11'S, 136°44'E, Oct 1972, *Latz* 3356 (AD, BRI, DNA); Stevens Is, The Wessels, 11°34'S, 136°06'E, Dec 1987, *Russell-Smith* 4527 & *Lucas* (DNA); On rocks near the Giddy River, 12°22'S, 136°42'E, *Symon* 7870 (CANB); cult. Emerald Ck (ex plant collected at Obiri Rock, East Alligator River Crossing, 12°23'S, 132°56'E), *Liddle* IML623 (BRI); East Alligator River area, near Mt Howship, Arnhem Land, 12°35'S, 133°10'E, Feb 1984, *Jones* 1461 (CANB, DNA); Buffalo Springs, Mt Brockman, 5 km NE of Koongarra, 12°50'S, 132°53'E, May 1980, *Lazarides* 8912 (CANB); Badalingarmirri Ck, Arnhem Land, 12°53'S, 135°50'E, Sep 1985, *Weightman* 2227 (CANB, DNA); 2 miles W of old BHP airstrip, 12°54'S, 135°28'E, *Symon* 7737 (AD, DNA, PERTH); Florence Falls, Tabletop Range, 13°06'S, 130°46'E, May 1985, *Dunlop* 6815 (BRI, DNA); top of Wangi Falls, 13°11'S, 130°49'E, Aug 1986, *Smith* 52 (DNA); Tabletop Range, 13°13'S, 130°43'E, Nov 1989, *Forster* 6077 (BRI); Barrk Malam walk, Jim Jim Falls, 13°16'S, 132°50'E, Dec 1989, *Forster* 6126 (BRI); Edith River, 14°09'S, 132°16'E, Sep 1974, *Dunlop* 3644 (DNA); Ruined City, 50 km NNE of Ngukurr, 14°17'S, 134°55'E, Nov 1987, *Russell-*

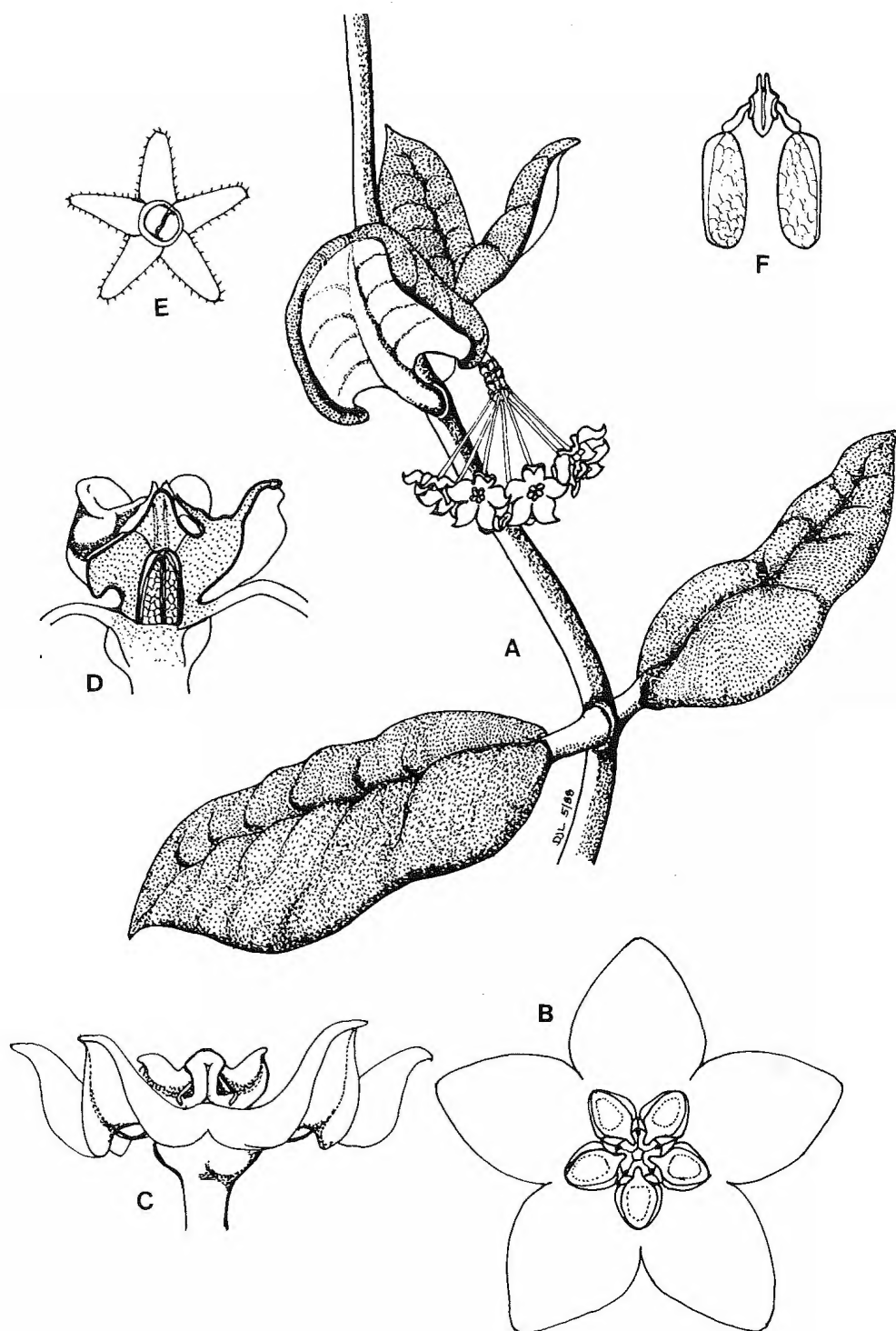


Fig. 7. *Hoya australis* subsp. *oramicola*: A. habit of flowering plant $\times 0.5$. B. apical view of flower $\times 3$. C. side view of flower $\times 3$. D. vertical cross-section of flower $\times 6$. E. apical view of calyx and ovaries $\times 3$. F. pollinarium (inverted) $\times 20$. A–F, Liddle IML123. Del. D.J. Liddle.

Smith 4190 & *Lucas* (DNA); Katherine Gorge N.P., 14°18'S, 132°28'E, Apr 1968, *Byrnes* 623 (DNA); Macadam Range, 14°41'S, 129°44'E, Mar 1989, *Russell-Smith* 7456b & *Lucas* (DNA).

Distribution and habitat: This subspecies occurs in the Kimberley region of Western Australia and over much of the top end of the Northern Territory (**Map A**). Plants grow on sandstone outcrops and cliffs.

Phenology: Flowers January to March; fruits 3–4 months later.

Conservation status: This subspecies is commonly encountered throughout its range and is not endangered. It is represented in a large number of conservation reserves such as Litchfield Conservation Park and Katherine and Kakadu National Parks in the Northern Territory.

Notes: This subspecies generally occurs as an erect subshrub although this would appear to be a result of the exposed habitats in which it normally occurs. For example at Jim Jim Falls, Northern Territory, the plants may cascade down rock faces for up to 20 m. Subspecies *rupicola* is distinctive within *H. australis* in that it is the only subspecies that does not twine, but throws out long runners that may clamber over surrounding rocks and vegetation. Leaves are very succulent and this may be interpreted as an adaptation to the marked monsoon environment in which it occurs.

While subsp. *rupicola* is a very distinctive plant, particularly as regards habit and the very succulent leaves, this distinctiveness is lessened by the recognition of subsp. *oramicola* as a link between subsp. *rupicola* and the other subspecies. While flowers in the majority of populations of subsp. *rupicola* do have large calyces (cf. Hill 1988), several (*George* 12639 and *Liddle* IML623) do not so this attribute cannot be used effectively as a diagnostic character.

4. *Hoya australis* subsp. *oramicola* P. Forster & D. Liddle subsp. nov. ab subsp. *australis* foliis ad basin laminae nectaria extrafloralia carentibus, maginibus laminae valde recurvis differt. **Typus:** Northern Territory. 7 km NE Lubra Point, Bathurst Island, 1 July 1988, *J. Russell-Smith* 5812 & *D. Lucas* (holo: DNA!).

Vine. Foliage with sparse to dense indumentum. Leaf lamina succulent, lacking extrafloral nectaries at base, greater than 5 cm long; margins strongly recurved; secondary venation obscure. **Fig. 7.**

Specimens examined: Northern Territory. Conder Point, Melville Island, *Russell-Smith* 2410 & *Lucas* (DNA); ditto, Nov 1989, *Forster* 6086 & *Russell-Smith* (BRI); cult. Emerald Ck (ex plant putatively from Talc Head, Darwin area), Feb 1988, *Liddle* IML424 (BRI); cult. Emerald Ck (ex plant putatively from Mandorah, Darwin area), Feb 1988, *Liddle* IML123 (BRI).

Distribution and habitat: This subspecies is apparently restricted to Melville and Bathurst Islands north of Darwin in the Northern Territory (**Map B**). Material in cultivation is labelled as Talc Head and Mandorah, both localities near Darwin. We have not been able to relocate plants at these localities. Plants grow as canopy lianes in monsoon vine thicket on red laterite on Melville and Bathurst Islands.

Phenology: Flowers July; fruits 3–4 months later.

Notes: This subspecies appears to be intermediate between subsp. *rupicola*, which does not twine and occurs on sandstone, and the twining subsp. *sanae*, which occurs in vine thickets on sand-dunes.

Conservation status: This subspecies has been rarely collected and the small populations on Melville and Bathurst Islands should be monitored and conserved.

5. *Hoya australis* subsp. *sanae* (Bailey) K. Hill, Telopea 3: 251 (1988); *Hoya sanae* Bailey, Queensland Agric. J. 1: 229 (1897) ("sana"). **Type:** Queensland. COOK DISTRICT: Polo Creek, Somerset, *F.L. Jardine* (holo: BRI!). **Illustrations:** Bailey, Compr. cat. Queensland pl. t. 308 (1913); *Liddle*, *Hoya* in Australia Figs 8 & 9 (1986).

Vine. Foliage with sparse to dense indumentum. Leaf lamina succulent, less than 5 cm long, usually lacking extrafloral nectaries at base, but occasionally present; margins strongly recurved; secondary venation prominent. **Fig. 8.**

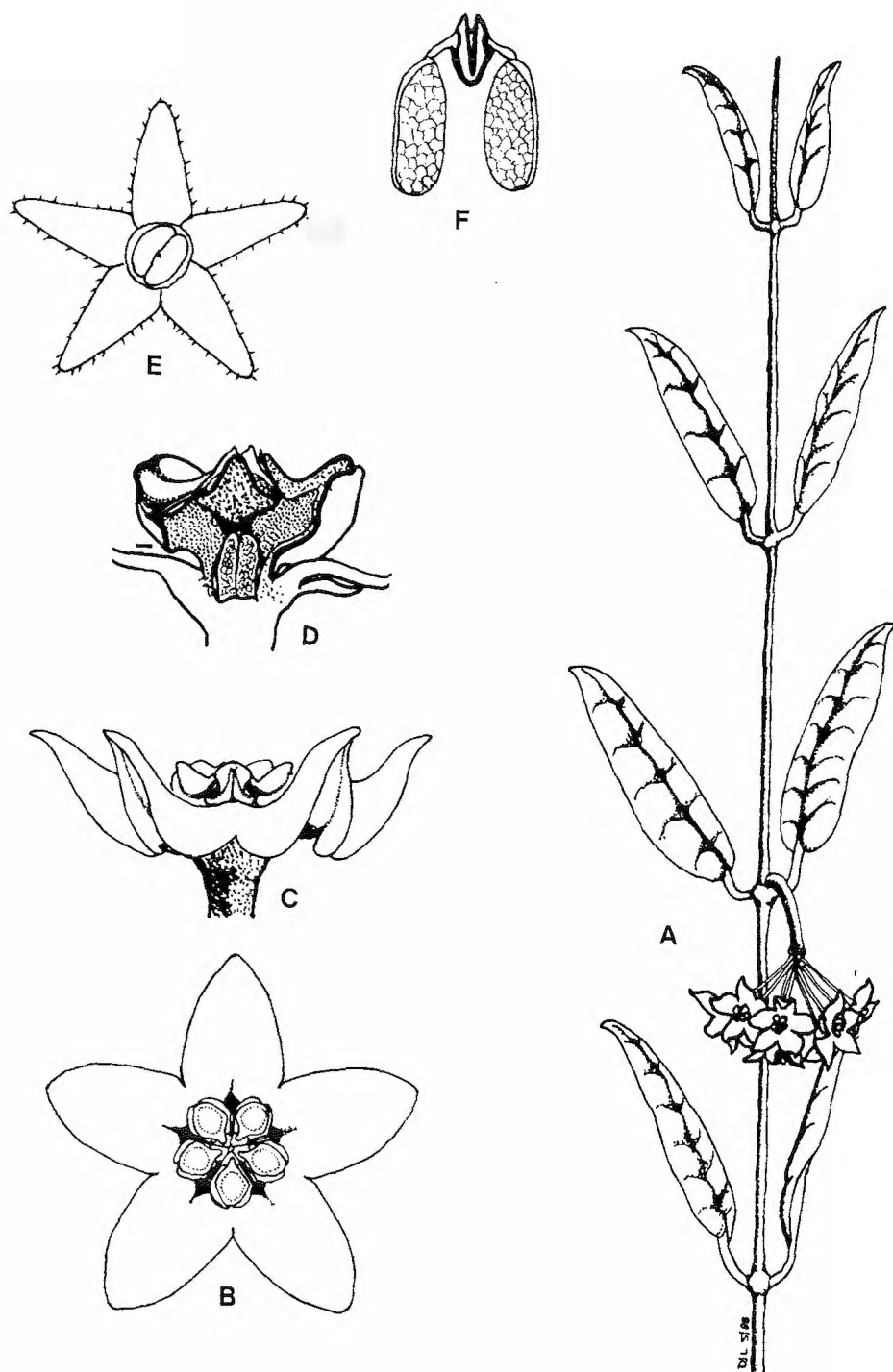


Fig. 8. *Hoya australis* subsp. *sanae*. A, habit of flowering plant $\times 0.5$. B, apical view of flower $\times 2.5$. C, side view of flower $\times 2.5$. D, vertical cross-section of flower $\times 5$. E, apical view of calyx and ovaries $\times 5$. F, pollinarium (inverted) $\times 20$. A-F, Liddle IML171a. Del. D.J. Liddle.

Selected specimens: Australia. Queensland. COOK DISTRICT: Badu Is, Torres Strait, 10°07'S, 142°09'E, Jul 1979, *Garnett* 132 (BRI); Banks (Moa) Is, Torres Strait, 10°10'S, 142°15'E, Feb 1975, *Cameron* 20582 (QRS); c. 2 km S of Cape York, 10°43'S, 142°32'E, Jun 1988, *Forster & Liddle* 4436, 4437 (BRI); Ida Is, Torres Strait, 10°43'S, 142°34'E, Oct 1983, *Liddle* IML289 (BRI); 1 km S of Punsand Bay, 10°44'S, 142°29'E, Jun 1988, *Forster & Liddle* 4439 (BRI); Newcastle Bay, 2.5 miles S of Somerset, *Brass* 18771 (BRI,CANB); Newcastle Bay, headland between Narau & Nanthau beaches, 10°47'S, 142°35'E, Feb 1990, *Forster* 6381 (BRI); 1 km E of Muttee Head, 10°55'S, 142°15'E, Jun 1988, *Forster & Liddle* 4474 (BRI); Muttee Head, 10°56'S, 142°17'E, Apr 1982, *Liddle* IML171a,b (BRI); Tributary of Escape River, *Clarkson* 2083 (BRI); cult. Emerald Creek (ex plant collected at Captain Billy Ck, 11°38'S, 142°51'E), May 1988, *Collins* IML31 (BRI); Olive River, 12°10'S, 143°05'E, Sep 1974, *Hyland* 7497 (BRI,QRS); Turtle Bay, Jul 1943, *Blake* 14973 (BRI); c. 1 km along road to Bolt Head, off road from Maloneys Springs, 12°28'S, 143°01'E, Jun 1989, *Forster & Liddle* 5525 (BRI).

Distribution and habitat: This subspecies occurs on Cape York Peninsula, Queensland and several offshore islands (**Map B**). Plants grow in foreshore monsoon vine thickets on white sand.

Phenology: Flowers May-June; fruits 3–4 months later.

Notes: As with subsp. *oramicola* the most distinctive features of subsp. *sanae* are the strongly recurved margins of the leaf lamina that may almost touch one another when the leaves are strongly desiccated during the dry season. This feature is not particularly noticeable on dried material and may explain why Hill did not comment on this characteristic in his account. Although Hill stated that "zones of intergradation [of this subspecies] with subsp. *australis* occur around Cooktown and somewhat south of there" our field studies showed that the populations from Silver Plains and Silver Valley are referable to subsp. *australis*.

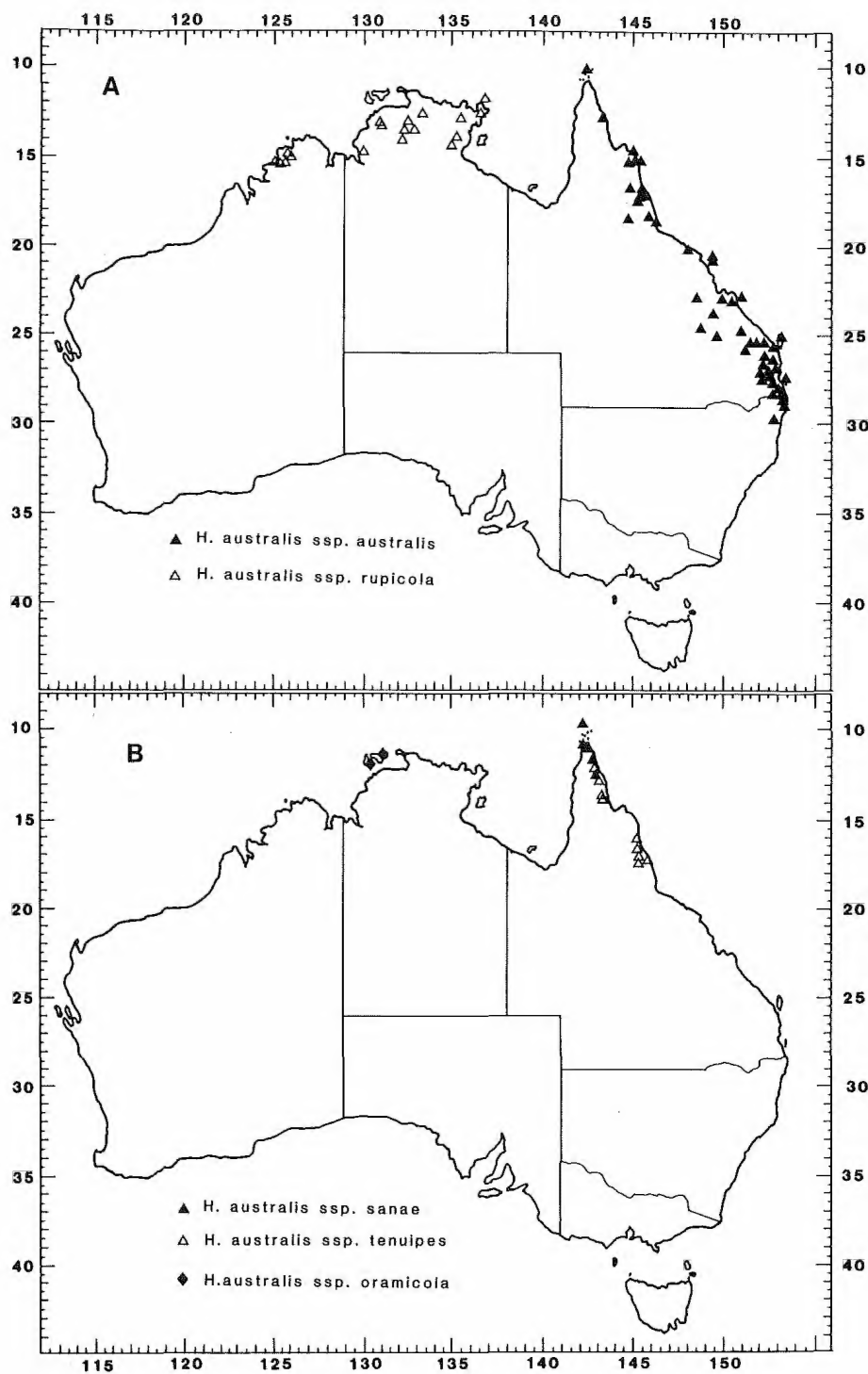
Bailey originally spelt the epithet as "sana" but as the taxon was named for Mrs Sana Jardine, the correct spelling of the epithet is "sanae".

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A large number of people and some institutions have aided this revision in the collection or provision of live material and we would like to thank E. Anderson; Australian National Botanic Gardens, Canberra; G. Batianoff; L. Bird; P. Bostock; D. Brewer; J. Clarkson; R. Collins; J. Conran; A. Cribb; D. Cumming; G. Defina; R. Dowling; G. & A. England; B. Ghen; B. Gray; K. Halfpapp; G. Hardy; R. Harvey; H. Hepburn; M. Hodge; B. Hyland; K. Kenneally; G. Kenning; P. Lavarack; R. Lockyer; R. McIlwain; M. O'Brien; M. Olsen; Mount Coot-tha Botanic Gardens; D. Orford; G. Sankowsky; V. Scarth-Johnson; P. Sharpe; M. Smith; J. Russell-Smith & D. Lucas; M. Telfer; M. Thorsborne; M. Tucker; V. Watts; K. Williams and the various landholders from whose property plants were obtained. The Directors/Curators of A, B, BISH, BM, BRI, CANB, CBG, DNA, JCT, K, L, MEL, QRS, P, PERTH and US provided access to material, either on loan or at their institutions. Staff at the Queensland Herbarium organised and processed loan material. The Queensland National Parks and Wildlife Service and the Queensland Forest Service provided various permits to collect material in areas under their jurisdiction. The Australian Biological Resources Study provided funding to P.I. Forster during 1988 to 1990. All of this assistance is gratefully acknowledged.

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Maps A & B. Distribution of *Hoya australis* in Australia. A. ▲ subsp. *australis*; △ subsp. *rupicola*. B. ▲ subsp. *sanae*; △ subsp. *tenuipes*; ◆ subsp. *oramicola*.

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Appendix 1. Index to numbered collections of *Hoya australis* examined, based on holdings at BRI, CANB, DNA, JCT, PERTH, QRS and partial holdings at A, BISH and L.

- 1a. *H. australis* subsp. *australis*
- 1b. *H. australis* subsp. *oramicola*
- 1c. *H. australis* subsp. *rupicola*
- 1d. *H. australis* subsp. *sanae*
- 1e. *H. australis* subsp. *tenuipes*

Note: Individual collectors in the NGF/LAE series are not named.

Adams 935:1c.

Barlow 355:1a; Batianoff & McDonald 222:1a, 568:1a, 688:1a, 1271:1e; Blake 4744:1a, 11287:1a, 14973:1d, 15280:1a, 15392: 1a, 15821: 1a, 21705:1a; Brass 2509:1a, 18771:1d, 25953:1e, 32545:1e; BSIP3934:1e; Byrnes 623:1c, 2485:1c.

Cameron 2573:1d, 20582:1d; Carr 13467:1e; L.E.Cheesman 50:1e; Clarkson 2083: 1d; Collins IML31:1d; Craven 8235:1c; Craven & Schodde 1459:1a.

Dillewaard & Olsen 276:1a; Dockrill & Stevens 374:1a; Dunlop 3644:1c, 5696:1c, 6815:1c.

Feuilletau de Bruyn 121:1e; Fitzsimon 189:1e; Forster 732:1a, 1543:1a, 1656:1a, 1755:1a, 1771:1a, 1783:1a, 1785:1a, 1792:1a, 1795:1a, 1805:1a, 1845:1a, 1851:1a, 1852:1a, 1853:1a, 1856:1a, 1857:1a, 1859:1a, 1883:1a, 1974:1a, 2002:1a, 2005:1a, 2036:1a, 2047:1a, 2070:1a, 2137:1a, 2171:1d, 2265:1a, 2271:1e, 2272:1a, 2274:1a, 2317:1a, 2330:1a, 2332: 1a, 2333:1a, 2335:1a, 2375:1a, 2377:1a, 2380:1e, 2382:1e, 2383:1a, 2394:1e, 2398:1a, 2418:1a, 2424:1a, 2499:1a, 2575:1a, 2655:1a, 2721:1a, 2722:1a, 2906:1a, 2962:1a, 3964:1a, 4275:1a, 6074:1c, 6077:1c, 6079:1c, 6080:1c, 6086:1b, 6381: 1d; Forster & Bird 1854:1a, 2153:1a, 2328:1a, 2881:1a; Forster & Bostock 2052:1a, 2066:1a; Forster & Hoy 5000:1a; Forster & Liddle 4436:1d, 4437:1d, 4439:1d, 4474:1d, 5525:1d; Forster & Russell-Smith 6086:1b; Forster & Telfer 1566:1a, 1569:1a; Forster *et al.* 1860:1a, 1868:1a, 1871:1a, 2071:1a, 2077:1a; Fox 2548:1c; Fryxell, Craven & Stewart 4734:1c;

Gardner 1394: 1c; Garnett 132:1d; George 12639:1c, 12800:1c; Gray 803:1e, 804:1e, 1648:1e, 2036:1d, 4373:1e.

Halfpapp IML486:1e, IML610:1a; Halle RSNH6330:1a; Hartley 10757:1e, 10862:1e; Hearne 142:1c; Henderson *et al.* 840:1a; Heyligers 1054:1a; Hodge IML35:1a; Hoogland 4509:1e, 5188:1e, 9000:1e; Hyland 6708:1a, 6807:1a, 7497:1d, 8875:1e, 9428:1e.

D. Jones 1461:1c; W. Jones 1471:1e, 2537:1d, 2951:1a.

Kanis 1101:1a; Kenneally 2188:1c, 4805:1c, 5075:1c, 7788:1c, 7907:1c; Kenning IML532:1a, IML566:1a; Kostermans 2715: 1e.

Latz 3356:1c; Lavarack IML385:1a, IML528:1a; Lazarides 8912:1c; Liddle IML series, 1:1e, 2:1e, 3:1e, 4:1e, 5:1a, 6:1a, 7:1a, 8:1a, 25:1e, 26:1e, 27:1e, 28:1e, 33:1e, 34:1e, 38:1e, 119:1a, 124:1b, 157:1c, 164:1a, 171a,b:1d, 173:1d, 206:1a, 208:1a, 210:1a, 257:1a, 264:1a, 277:1e, 288:1a, 289:1d, 367:1a, 384:1e, 424:1b, 441:1a, 442:1a, 599:1a, 600:1a, 603:1a, 606:1a, 615:1e, 623:1c, 758:1d, 760:1d.

Mackenzie 710307-8:1c; McDonald & Batianoff 1619A:1a; McKee 9335:1a, 40077:1e; Morat 5489:1a; Moriarty 494:1a; Must 959:1c.

Neldner 820:1a; NGF & LAE series, 9968:1e, 9984:1e, 10323:1e, 14044:1a, 18753:1e, 22744:1e, 26932:1e, 27876:1e, 28579:1e, 33759:1e, 35199:1e, 35650:1e, 36718:1a, 38401:1e, 38486:1e, 40533:1e, 50489:1e, 77254:1e.

O'Brien IML366:1a.

Pajmans 481:1e; Pullen 8158:1e.

Russell-Smith & Lucas 2410:1b, 4190:1c, 4527:1c, 5812:1b, 7456b:1c;

Schodde 2445:1e, 2971:1e, 2976:1a; Sharpe 1759:1a, 4689:1a; Sharpe & Durrington 448:1a; Smith 52:1c; Sore 2331: 1e; Specht & Specht LI335:1a, LI383:1a; Stoddart 4622:1a, 4652:1a; Symon 5124:1c, 7737:1c, 7870:1c.

Trapnell 121:1a, 284:1e. Trapnell & Williams 201:1a.

Webb 931:1e, 1441:1a, 4739:1a; Webb & Tracey 9774:1a, 11623:1a, 13646:1e.

van Royen 6631:1e; van Royen & Sleumer 5715:1e.

Webster & Hildreth 15253:1e; White 9945:1a; Wightman 2227:1c; Williams 219:1e, 8217:1e; Wilson 1002:1a.

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NOTES ON *ASTROTRICHA* DC. (ARALIACEAE) IN QUEENSLAND

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Summary

Astrotricha cordata and *A. intermedia*, both with affinity to *A. pterocarpa* Benth., are described as new. A description of *A. pterocarpa* s. str. is provided. The correct name for Queensland plants previously known as *A. floccosa* DC. is shown to be *A. latifolia* Benth. A key to the Queensland species is presented.

Introduction

Astrotricha is an endemic Australian genus comprising 15–20 species. The genus is largely confined to Victoria, New South Wales and Queensland, while there is one species endemic to the Hamersley Range area of Western Australia.

A. pterocarpa was named by Benthham from specimens collected in north Queensland, the epithet meaning 'winged fruit'. Subsequently the name *A. pterocarpa* has been applied to all specimens of *Astrotricha* which possess winged fruit, despite floral and vegetative differences which occur in southern Queensland specimens.

A. pterocarpa, as previously circumscribed, comprises three taxa which have in common their winged fruit, large inflorescence and single-stemmed habit. These taxa are quite striking in the field, standing tall over surrounding shrubs. They have not been extensively collected, probably due to the large size of the leaves and inflorescences, and the difficulty of making a suitable herbarium specimen. There is however ample fertile material for the purpose of describing the taxa in this group.

In addition to absolute measurements and shape, the characters used for distinguishing taxa of this group have been the colour of petals, rachises and fruits; the presence or absence of indumentum, the colour of the indumentum; presence of stipules, shape of the midrib of the leaves, leaf peltation and the number of flowers per inflorescence.

This paper also reports on the misapplication of the name *A. floccosa* DC. for plants indigenous to Queensland. Specimens previously identified as *A. floccosa* are referable to *A. latifolia* Benth.

Taxonomy

Astrotricha cordata A. Bean sp. nov. affinis *A. pterocarpace* a qua foliis multum latoribus cordatis, floribus purpureis et inflorescentiis glabris differt. **Typus:** Blackdown Tableland, c. 35 km SE of Blackwater, September 1971, R.J. Henderson H1018, L. Durrington and P. Sharpe (holo: BRI).

Slender shrub up to 6 m high, usually single-stemmed. Lower parts of stem glabrous, marked by leaf scars, upper parts of stem densely stellate-tomentose, white. Leaves spirally alternate, often with a pair of leafy stipules each up to 5 × 2 cm at the base of the petiole; petioles terete, 12–21 cm long, densely stellate-pubescent, creamy white; blades discolourous, ovate, apex acute, base cordate, sometimes peltate, 17–27 × 9–16 cm; upper surface of newly developed leaf blades stellate-pubescent, becoming glabrous and dark green with maturity; leaf blade undersurface densely stellate-pubescent, creamy white; midrib and major veins impressed on upper surface, raised below; midrib rounded in cross-section. Inflorescence a large terminal panicle, up to 120 × 60 cm, purple or brown in colour, glabrous except for the bracts which possess a few stellate hairs; bracts linear, 2–10 mm long; unit inflorescence umbellate, 7–14-flowered. Peduncles and pedicels slender; pedicels 4–8 mm long. Flowers unisexual or bisexual, glabrous, purple, with 5 small, acute calyx teeth, petals 5, acute, caducous; stamens 5, purple, alternating with the petals; anthers dehiscing by longitudinal slits; ovary inferior, 2-locular, styles 2, recurved. Fruit a schizocarp, rarely dehiscent, glabrous, slightly fleshy, laterally compressed, elliptical, 10 × 5 mm, surmounted by persistent styles; initially not winged, as

fruits mature epicarp expanding to form two distinct papery wings, at right angles to orientation of fruit and styles; wings each c. 11×5 mm; pedicels 8–13 mm long. **Fig. 1.**

Selected specimens: Queensland, LEICHHARDT DISTRICT: Expedition Range, E of Rolleston, Sep 1962, *Story & Yapp* 268 (BRI,CANB); Mt Playfair-Mt Faraday area, Sep 1982, *O'Keeffe* s.n. (BRI); Salvator Rosa N.P., Sep 1990, *Bean* 2316 (BRI); Carnarvon Gorge, on track to Bulimba Bluff, Dec 1989, *Makinson* 498 (BRI,CANB,CBG,NSW); Glenmoral Gap, 13 km WSW of Theodore, Sep 1986, *Forster* 2633 (BRI); Nathan Gorge, SW of Cracow, Oct 1989, *Bean* 1140, 1141, 1142 (BRI). BURNETT DISTRICT: hills N of St John Creek, W of Eidsvold, Oct 1989, *Bean* 1143, 1144 (BRI); Dead End Lookout, Coomanglah S.F., Oct 1983, *Henderson* H3003 (BRI); "Manar", Rocky Paddock, 45 km SSE of Mundubbera, Nov 1984, *Forster* 1931 (BRI). WIDE BAY DISTRICT: Mount Walsh, near Biggenden, Jun 1983, *Bean* 22 (BRI). New South Wales, Carrawarra Ridge, Mt Neville area, NNW of Grafton, Jun 1984, *Benson & Dodkin* 35 (NSW).

Distribution and habitat: *A. cordata* is widely, though sporadically distributed in south-eastern Queensland from Blackdown Tableland ($23^{\circ}45'S$) to south of Mundubbera ($26^{\circ}00'S$). It is also known from a single locality in New South Wales, NNW of Grafton (see above). This is a remarkable disjunction, being almost 400 km from the nearest Queensland locality (**Map 1**). *A. cordata* inhabits skeletal soils derived from sandstone, granite, or occasionally rhyolite. It occurs as a component of open eucalypt woodland and tends to grow in open rocky areas or cliff lines.

Flowering period: September to November.

Notes: This species has been observed to be monocarpic, that is, it grows for a few years, flowers once, fruits, then dies. Fruiting plants often have already shed all their leaves, and soon after the fruits mature, the plant dies. Sometimes however, apparently dead plants will sucker from ground level. These growth characteristics also occur in the related species, *A. pterocarpa* and *A. intermedia*.

A. cordata is readily distinguished from *A. pterocarpa* by its broader leaf blades with a cordate base, midrib rounded in cross-section, longer petioles, white indumentum, purple flowers, glabrous inflorescences and longer pedicels.

Conservation status: *A. cordata* is widespread and occurs within several National Parks.

Etymology: The specific epithet refers to the distinctly cordate leaves of this species at all stages of growth.

***Astrotricha intermedia* A. Bean sp. nov.** affinis *A. pterocarpace* a qua foliis aliquantum latioribus, floribus glabris purpureis et inflorescentiis glabris floribus paucioribus differt. **Typus:** Nogoa River camping area, Salvator Rosa National Park, 9 December, 1989, *R.O. Makinson* 600 (holo: BRI; iso: CANB,NSW).

Slender shrub up to 6 m high, usually single-stemmed. Lower parts of stem glabrous, upper parts of stem stellate-tomentose. Leaves spirally alternate, stipules absent; petioles up to 10 cm long, densely stellate-pubescent, creamy yellow to brown. Blades discolourous, lanceolate with apex acuminate and base obtuse, occasionally hastate, $14\text{--}22 \times 3.3\text{--}5.5$ cm; upper surfaces dark green, glabrous; undersurfaces of blade densely stellate-pubescent, creamy yellow to brown; midrib impressed on upper surface, prominent below, acute in cross-section. Inflorescence a large terminal panicle, purple to almost black in colour, glabrous except for stellate hairs on bracts; bracts linear, 2–8 mm long; unit inflorescence umbellate, 7–11-flowered. Pedicels slender, 6–9 mm long. Flowers mostly bisexual, glabrous, purple, with 5 small, acute calyx teeth; petals 5, acute, caducous; stamens 5, purple, alternating with the petals; anthers dehiscing by longitudinal slits; ovary inferior, 2-locular, styles 2, recurved. Fruit a schizocarp, rarely dehiscent, glabrous, slightly fleshy, laterally compressed, elliptical, 10×5 mm, surmounted by persistent styles; initially not winged, as fruits mature epicarp expanding to form two papery wings, at right angles to orientation of fruit and styles; wings each c. 9×5 mm; pedicels 8–10 mm long. **Fig 1.**

Selected specimens: Queensland, PORT CURTIS DISTRICT: Byfield, Sep 1931, *White* 8140 (BRI); Canoona, 30 miles [48 km] north-west of Rockhampton, Sep 1943, *Blake* 15317 (BRI); Bulburin State Forest, Apr 1980, *McDonald* 3215 *et al.* (BRI); Blackmans Gap, SW of Miriam Vale, Sep 1990, *Bean* 2405, 2406 (BRI). LEICHHARDT DISTRICT: 11 miles [18 km] E of 'Mantuan Downs', Apr 1946, *Everist* 2550 (BRI); Main Range, between Alpha and Tambo, Aug 1966, *Gittins* T79 (BRI); Nogoa River, Salvator Rosa N.P., Aug 1977, *Blaxell* 1489 & *Armstrong* (BRI,NSW); 'Riverside', W of Springsure, Oct 1987, *O'Keeffe* 878 (BRI).

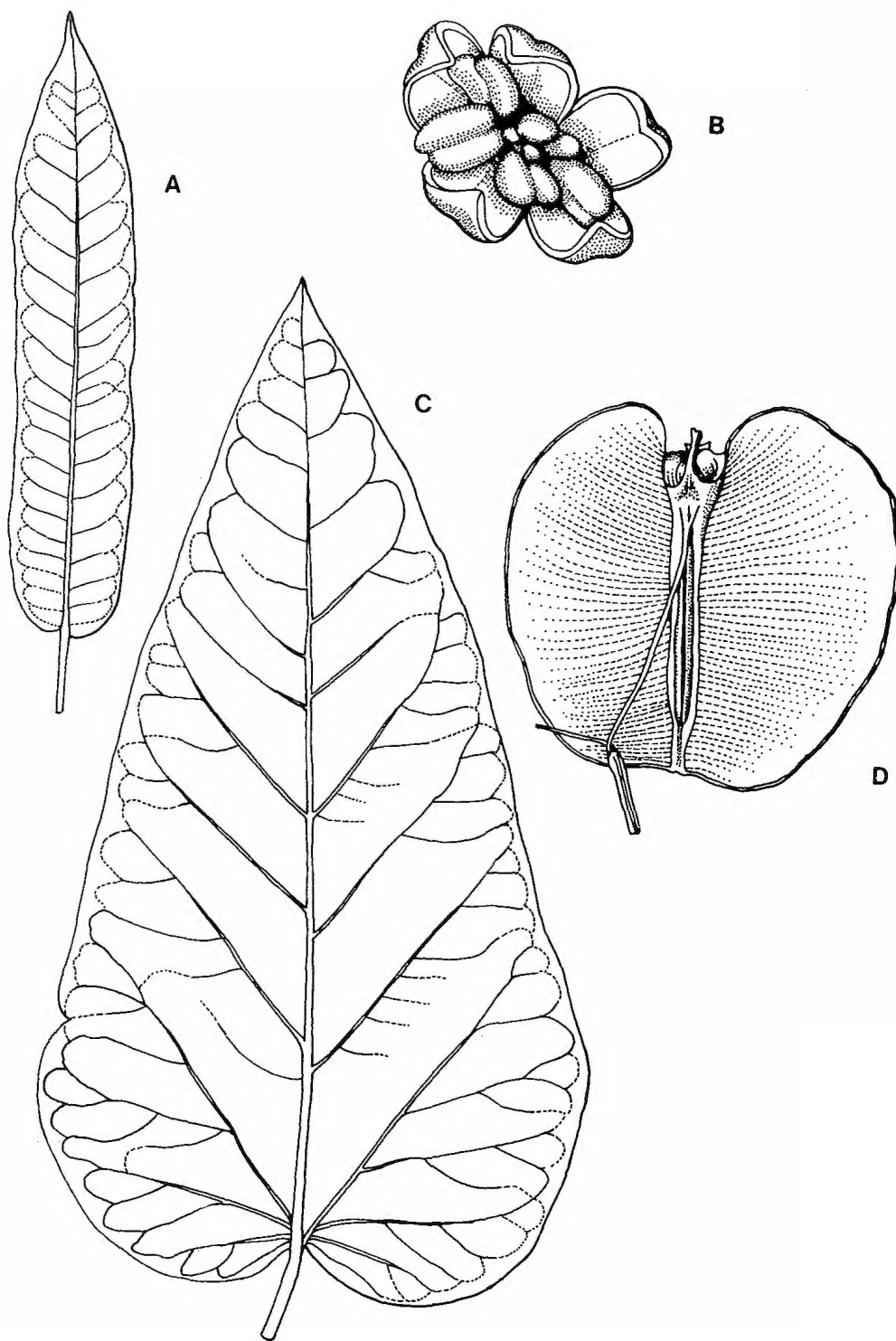


Fig. 1. *Astrotricha intermedia*: A. leaf $\times 0.5$. B. flower $\times 8$. *Astrotricha cordata*: C. leaf $\times 0.5$. D. fruit $\times 4$.

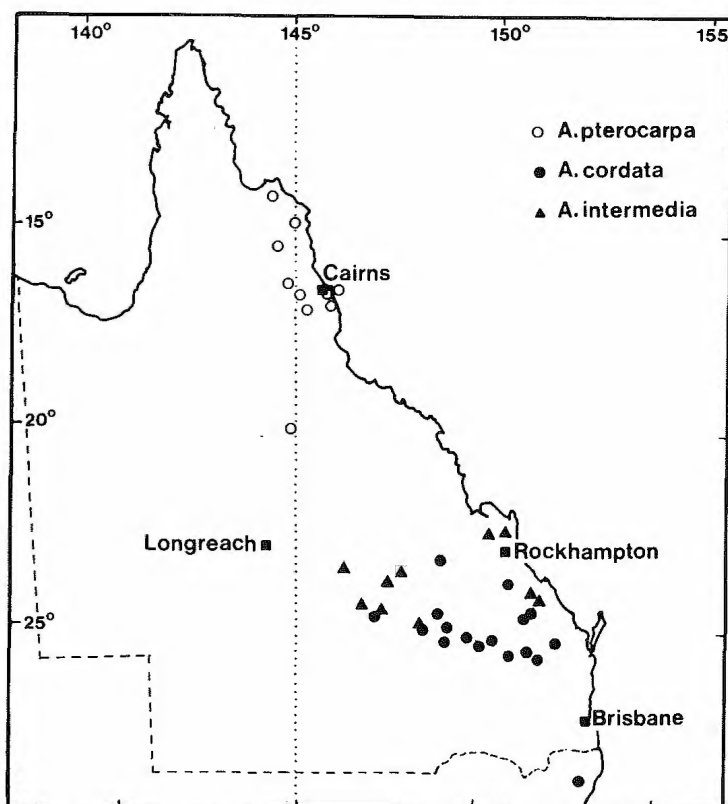
Distribution and habitat: *A. intermedia* has a broad, but disjunct distribution. It is found in a few areas near Rockhampton and then on the sandstone belt around Springsure and Tambo (Map 1). It grows in open eucalypt woodland, in shallow sandy soils over sandstone, or occasionally on serpentinite.

Flowering period: September to November.

Notes: Plants with hastate leaf bases occur in the Salvator Rosa N.P. While this leaf shape is unique in the genus, so far as is known, its occurrence is sporadic, and not correlated to any other morphological differences, and so is not likely to be of any taxonomic significance. The flowers and inflorescences of *A. intermedia* are very similar to those of *A. cordata*, but the species may be readily and consistently distinguished as *A. intermedia* has much narrower leaves, shorter petioles, midrib acute in cross-section, yellowish or brownish tomentum and never has stipules. It is notable that these two species grow in adjoining populations in the Carnarvon National Park without intergradation. Juvenile plants of *A. intermedia* may be confused with those of *A. cordata*, as the leaves of the former are broader at that stage.

Conservation status: *A. intermedia* is moderately widespread, and is conserved in the Carnarvon National Park.

Etymology: The specific epithet is a reference to this species being intermediate, geographically and morphologically, between *A. cordata* and *A. pterocarpa*.



Map 1. Distribution of *Astrotricha* spp.

***Astrotricha pterocarpa* Benth.** Fl. austral. 3: 379 (1867). Type: Fitzroy Island, W. Hill (K, photo!).

Slender shrub up to 7 m high, usually single-stemmed. Lower parts of stem glabrous, marked by leaf scars, upper parts of stem covered by brown stellate tomentum. Leaves spirally alternate, stipules absent; petioles 5.5–12.5 cm long, flattened at base, covered by dense brown stellate tomentum; blades discolourous, lanceolate, apex acute, base obtuse or slightly cordate, mostly 15–27 × 1.7–4.0 cm, glabrous and dark green above; leaf blade below covered by brown dense stellate tomentum; midrib impressed above, prominent below, acute in cross-section. Inflorescence a terminal panicle, up to 100 × 50 cm; rachises, peduncles and pedicels all floccose, with stellate hairs; bracts linear, 2–10 mm long; unit inflorescence umbellate, 10–15-flowered. Flowers mostly bisexual, creamy or pale green, calyx teeth 5, small, acute; petals 5, hairy outside, glabrous inside, caducous; stamens 5, creamy, alternating with the petals, anthers dehiscing by longitudinal slits; ovary inferior, 2-locular, styles 2, recurved. Fruit a schizocarp, rarely dehiscent, pubescent, slightly fleshy, laterally compressed, elliptical, c. 12 × 7 mm, surmounted by persistent styles; initially not winged, as fruits mature epicarp expanding to form two distinct papery wings, at right angles to orientation of fruit and styles; wings each c. 11 × 5 mm; pedicels 4–5 mm long.

Selected specimens: Queensland. COOK DISTRICT: Altanmoui, Jul 1972, Hyland 6346 (QRS); east of Jowalbinna-Maytown road, Jul 1990, Bean 1768 (BRI); Isabella Falls, NW of Cooktown, Jul 1990, Bean 1953, 1954 (BRI); Mount Mulligan, 40 km NW of Dimbulah, Apr 1985, Clarkson 5908 (BRI); Fitzroy Island, Oct 1946, Flecker 10510, 10511 (NSW, QRS); Watsonville, Nov 1931, Gallogly s.n. (BRI); ridge above Yarrabah, Sep 1986, Starkey 62 (QRS); Walsh's Pyramid, Sep 1972, Webb & Tracey 13778 (BRI); above Bessie's Creek Falls, Jul 1937, Flecker 3633 (BRI, QRS). NORTH KENNEDY DISTRICT: 8 miles [13 km] W of Pentland township, Jun 1953, Perry 3554 (BRI); 32 km SW of Pentland, Sep 1974, Williams 62 (BRI); 25 km W of Pentland on Great Dividing Range, Jul 1975, Chapman 1323 (BRI, CANB, K).

Distribution and habitat: *A. pterocarpa* is confined to north Queensland where it extends from the Melville Range area north of Cooktown southward to the Burra Range near Pentland (Map 1). It grows on shallow sandy soil, over sandstone, in eucalypt woodland.

Flowering period: July to October, but one flowering specimen collected in April.

Conservation status: *A. pterocarpa* is not known to be present in any conservation reserve, but it is not considered rare or endangered at this time.

Identity of *A. floccosa* DC.

Astrotricha floccosa DC. was one of the two species originally named by De Candolle based on specimens collected by Sieber in the vicinity of Sydney. For over 100 years, it has been accepted that *A. floccosa* occurs in Queensland. I have examined the type specimen of *A. floccosa* (Nova Hollandia, 1825, Sieber 258 (K, photo!)) and it clearly does not match any material found in Queensland.

The Queensland material matches that of a taxon widespread in New South Wales, and currently called *A. latifolia* Benth. in that state (Beadle 1980; Beadle *et al.* 1982; R.O. Makinson pers. comm.).

To date, attempts to locate the type of *A. latifolia* have proved unsuccessful (G. Leach pers. comm.). However in his original description (in Huet. Enum. 55.), Benth. states that the petioles of *A. latifolia* are '2–3 pollicari' long. This corresponds to approximately 5–8 cm long. The Queensland 'floccosa' material, and the New South Wales material determined as *A. latifolia* often have petioles which are of that length, but all other *Astrotricha* species (except the *A. pterocarpa* group) have petioles which are considerably shorter. Based on this, I concur with the use of *A. latifolia* in New South Wales, and propose that this name be taken up for the Queensland material previously identified as *A. floccosa*.

An unnamed species (sp. Q2 in the key below) occurs sporadically in northern New South Wales and southern Queensland. It resembles *A. floccosa* because of its very floccose indumentum, but in other respects, it is more closely related to *A. longifolia*.

Key to the Queensland species of *Astrotricha*

1. Tall shrubs (2–7 m), mostly unbranched; inflorescence >70 cm long;
fruits winged 2
Shrubs less than 3 m tall, mostly branched; inflorescence <45 cm long;
fruits not winged 4
2. Leaf blades 90–160 mm wide, base cordate, midrib rounded below *A. cordata*
Leaf blades 17–55 mm wide, base obtuse, midrib keeled below 3
3. Umbels 10–15-flowered; inflorescence woolly hairy, flowers creamy-white;
leaf blades 17–40 mm wide *A. pterocarpa*
Umbels 7–11-flowered; inflorescence glabrous, flowers purple; leaf blades
33–55 mm wide *A. intermedia*
4. Leaf blades below green, glabrous *A. glabra*
Leaf blades below white, grey or brown, pubescent 5
5. Leaf blades >18 mm wide, petioles >20 mm long *A. latifolia*
Leaf blades <18 mm wide, petioles <20 mm long 6
6. Leaf blades below, petioles and pedicels floccose or woolly hairy .. *A. sp. Q2*
Tomentum on leaf blade below and on petioles closely appressed 7
7. Leaf blades 3–6 mm wide; inflorescence glabrous, purple ... *A. biddulphiana*
Leaf blades 5–17 mm wide; inflorescence pubescent, white ... *A. longifolia*

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Mr Bob Makinson of the New South Wales National Herbarium, Sydney provided extra material, and my discussions with him were very useful. I am grateful to Paul Forster for his help and encouragement, to Les Pedley for the latin diagnoses, Greg Leach for locating types while Australian Botanical Liaison Officer at Kew, Will Smith for the illustrations and to Gordon Guymer and Estelle Ross for their willing assistance.

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NEW SPECIES OF *HIBBERTIA* ANDREWS (DILLENIACEAE) FROM AUSTRALIA

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Summary

Seven new species of *Hibbertia* (Dilleniaceae) viz *H. arnhemica*, *H. cymosa*, *H. hendersonii*, *H. laurana*, *H. mulligana*, *H. oligodonta*, and *H. pholidota*, and a new form of *H. banksii* viz *H. banksii* forma *rigidula* from Australia are described with notes on their affinities and distribution.

Introduction

The preparation of a Census of Queensland plants at BRI has necessitated a review of some of the genera in which there has been confusion with the identity of the species or where there were many known undescribed taxa. The genus *Hibbertia* (Dilleniaceae) is one of the many genera that have been studied.

Continued studies over the years at BRI, of the Queensland species of *Hibbertia*, have shown that there was much confusion with the identity of some of the species and several undescribed taxa. Many of the species contained more than one taxon, and there were also undescribed taxa closely related to some of the species. Confusion was particularly obvious in the following species or groups of species, viz *H. banksii*, *H. acicularis*, *H. stricta*, *H. cistoidea* and *H. longifolia*, and in the *H. linearis* – *H. obtusifolia* – *H. diffusa* group, *H. velutina* – *H. melhanioides* group, and the *H. cistifolia* – *H. oblongata* – *H. lepidota* groups. Recent collecting due to various floristic studies in Queensland and Northern Territory have made it possible to understand some of the above species and to segregate and describe the following new species and discuss their affinities.

Note: Bentham's division of *Hibbertia* into sections (1863, 1: 17–20) is followed in this account for easy reference of the relationship of the new species.

A. *Hibbertia banksii* (R. Br. ex DC.) Benth. and allies

Four distinct taxa are present in this group viz *H. banksii* (R. Br. ex DC.) Benth. with two forms, and the two species now described as *H. arnhemica* and *H. laurana*. These species have stamens on one side of the carpels, staminodes outside the stamens and two hairy carpels, and are referable to section *Hemistemma* (Juss. ex Thouars) Benth. (1863, p. 17). These species are easily distinguishable by their rusty tomentose stems and peduncles, spiciform inflorescences with secund flowers, and by the numerous stamens (20–50 per flower). Their leaves are discolorous and usually densely white hairy on the lower surfaces and with conspicuous rusty nerves, the margins are revolute, recurved or flat, entire, serrulate or dentate. These species may be separated from each other as follows:

1. Sepals 5–11 × 3–7 mm, elliptic or elliptic-ovate with subacute or obtuse apex; peduncles 0.7–4.5 cm long; leaf margins serrulate or entire 1. *H. banksii*
 Sepals 13–23 × 7–11 mm, elliptic, elliptic-ovate to obovate with acute-acuminate, obtuse or rounded apex; peduncles 0.7–2.7 cm long; leaf margins entire, dentate or denticulate 2
2. Leaves denticulate or dentate; petioles 8–12 mm long; bracts 6–7 × 2.5–3 mm; sepals rounded or obtuse at apex, 13–17 × 9–11 mm; stamens 30–50 per flower; spikes 3–5-flowered 2. *H. laurana*
 Leaves entire; petioles 0.5–3 mm long; bracts 8–21 × 2–15 mm; sepals acute-acuminate at apex, 15–23 × 7–10 mm; stamens 20–30 per flower; spikes 8–12-flowered 3. *H. arnhemica*

1. *Hibbertia banksii* (R. Br. ex DC.) Benth., Fl. austral. 1: 21 (1863). *Hemistemma banksii* R. Br. ex DC., Syst. Veg. 1: 414 (1817). **Type:** Queensland. COOK DISTRICT: Endeavour R., date unknown, *J. Banks* (n.v.).

Shrubs to 3 m, occasionally multistemmed; branchlets usually terete, densely tomentose with pale or rusty-brown hairs. Leaves elliptic, elliptic-oblong or subobovate, (3.7–)5–11 × (0.5–)1.6–4.5 cm; apex obtuse, emarginate, subtruncate or rarely subacute; margins entire or serrulate (teeth 1–6 on each side of the midrib), usually recurved; base obtuse, subacute or cuneate; thinly coriaceous or sometimes thick and slightly rigid; upper surfaces glabrous or hairy on the midrib; lower ones densely white tomentose except rusty or yellowish brown nerves and reticulate venation; lateral nerves 5–12 pairs, patent and looping at margins in entire-leaved forms, or slightly oblique and ending in marginal teeth in toothed-leaved forms; reticulate venation impressed above; petioles 3–12 mm long, pubescent. Spikes terminal or axillary, 2–8 cm long, 3–10-flowered; peduncles (from the lowest flower down) 1–4 cm long, rusty tomentose; bracts narrowly ovate or elliptic, 2–7 × 1–2 mm, often keeled, rusty hairy. Buds ellipsoid. Flowers 1.7–2.5 cm diameter; sepals ovate-elliptic or elliptic, 5–11 × 3–7 mm, obtuse or subacute, concave, slightly rigid, tomentose or villous outside, glabrous and shiny inside or hairy towards the apex inside; petals obovate, 2-lobed at apex, 9–23 × 7–15 mm; stamens 20–48; filaments free, filiform 1.5–2 mm long; anthers narrowly obloid, 2–4 mm long; staminodes 9–20, linear or clavate, 3–4 mm long; carpels 2, densely villous mostly at apex only, or tomentose; ovules 2 per carpel. Seeds 1 or 2 per carpel, obovoid or subglobose, covered by the pale membranous aril or with a small aril at its base.

The species varies considerably especially in its leaves, two forms are recognised, although they sometimes merge into each other at the extension of their range. They can be separated as follows:

1. Leaves 0.5–2.3 cm wide; margins entire or very sparsely toothed (teeth 1–3 on each side of the midrib); thinly coriaceous; petioles 3–7.5 mm long; spike usually with closely arranged flowers; peduncles 1.2–4 cm long; seeds usually covered by the aril **forma banksii**
- Leaves 2.5–4.5 cm wide, margins crenulate-serrulate (teeth 2–6 on each side of the midrib); slightly thick and rigid; petioles 5–12 mm long; spikes usually with separated flowers; peduncles 1–2.5 cm long; seeds usually with a small aril at its base **forma rigidula**

Hibbertia banksia* forma *banksii

Leaves narrowly elliptic to subobovate, 3.7–10.5 × 0.5–2.3 cm; apex obtuse, emarginate, subtruncate or subacute; margins entire or sparsely toothed, recurved; base subacute or cuneate; thinly coriaceous; lateral nerves patent, looping near the margin, or sometimes slightly oblique and ending in marginal teeth; reticulate venation closely reticulate, ± impressed on upper surfaces; petioles 3–7.5 mm long. Spikes with closely arranged flowers, terminal or axillary, peduncles 1.2–4 cm long; petals 10–11 × 7–9 mm; stamens 21–48; staminodes 10–20; carpels densely villous all over or only at apex. Seed usually enclosed in the aril.

Selected specimens: Papua New Guinea, WESTERN DIVISION: Timbuke, Wassi Kussa R., *Brass* 8431 (BRI). Australia, Queensland, COOK DISTRICT: Cape York, north of Jardine R. about 32 km NE of Bamaga, Oct 1971, *Dodson* s.n. (BRI); Sharp Point, Jun 1978, *Clarkson* 2116 (BRI); Olive R., Sep 1974, *Hyland* 7463 (BRI); N of Massey Ck, about 13 km NW of Silver Plains, Aug 1978, *Kanis* 2018 (BRI); upper reaches of Isabella Ck, NW of Cooktown, Jul 1990, *Bean* 1940 (BRI).

Distribution and habitat: Northern Queensland, from Cape York to Daintree R., and in southern New Guinea (**Map 1**); usually in deep sand in river flood banks and edge of swamps.

H. banksii forma *banksii* is distinguishable by the usually narrowly elliptic leaves, entire or sparsely toothed recurved margins, thin texture of the leaves with prominent impressed reticulate venation on upper surfaces; long peduncled spikes, elliptic-ovate sepals, and seeds usually covered by the aril.

***Hibbertia banksii* forma *rigidula* S. Reyn. forma nov.** differt a forma *banksii* (R. Br. ex DC.) Benth. foliis latioribus crassiusculis rigidulis, petiolis longioribus et arillo plerumque parvulo. **Typus:** Queensland, COOK DISTRICT: Tozer Gap, Iron Range, July 1948, *L.J. Brass* 19425 (holo: BRI).

Leaves oblong-elliptic to obovate, 4.5–11.5 × 2.5–4.5 cm; apex broad obtuse, emarginate or truncate; margins crenulate-serrulate, toothed mostly in the distal half with 2–6 small teeth on each side of midrib, flat or slightly recurved; base obtuse or subacute; thickly coriaceous and ± rigid; reticulation prominent, not impressed above; petioles 5–12 mm long. Spikes with loosely arranged flowers, axillary; peduncles 1–2.5 cm long; petals 9–23 × 8–15 mm; stamens 20–25; staminodes 9–14; carpels tomentose. Seed usually with a small aril at its base.

Selected specimens: Queensland, COOK DISTRICT: McDonnell heath, 11°35'S, 142°27'E, Jul 1970, *Isbell* s.n. (BRI); road between Heathlands and Captain Billy Ck, 11°36'S, 142°46'E, May 1980, *Morton* 639 (BRI); Iron Ra. Rd, about 1 km upstream from Brown Ck Crossing, Cape Weymouth, Apr 1988, *Forster* 4157 & *Liddle* (BRI); Tozer Gap, Iron Ra., Jul 1948, *Brass* 19425 (BRI); Kennedy Rd, 13 miles [20.8 km] NNE of Pascoe R. Crossing, Aug 1965, *Gittins* 1021 (BRI).

Distribution and habitat: Far northern Queensland, between McDonnell heath and Pascoe R., common around Iron Ra. (Map 2); usually in heathlands and sandy ridges; altitude 75–500 m.

Hibbertia banksii forma *rigidula* differs from forma *banksii* by its broader, thicker more rigid leaves, and by the very small aril at the base of the seed. Further collections may indicate this form is worth recognition at a higher rank.

Etymology: The epithet *rigidula* (Latin), slightly rigid, refers to the texture of the leaves of this form.

2. *Hibbertia laurana* S. Reyn. sp. nov. quoad aspectum foliorum, inflorescentias et indumentum *H. banksii* (R. Br. ex DC.) Benth. accedit sed ab ea differt essentialiter floribus multo majoribus, sepalis ellipticis vel obovatis, foliis latioribus et colore indumenti inflorescentiarum et foliorum multo pallido. **Typus:** Queensland, COOK DISTRICT: Mushroom Rock, 5°56'S, 144°24'E, 5.3 km east of Peninsula Development road on an IWS track leaving the main road, 0.5 km N of the Laura R., 26 April 1983, *J.R. Clarkson* 4710 (holo: BRI).

Shrubs 2–4 m tall, often robust and multi-stemmed; bark grey-brown, fissured; young parts densely rusty tomentose; branchlets terete, tomentose. Leaves elliptic, 7.5–9.5 × 2–3.7 cm, apex obtuse sometimes mucronulate, base obtuse, cuneate to subacute, margins remotely dentate or denticulate, recurved or revolute, ± rigid, upper surfaces slightly shiny, usually drying grey green, glabrous or nerves hairy, lower surfaces white tomentose, hairs brownish on lateral nerves and reticulate venation; lateral nerves 8–10 pairs, ± patent or oblique and ending in marginal teeth; upper surfaces rugose, with impressed, closely arranged reticulate venation; petioles 8–12 mm long. Spikes axillary, 3.5–5.5 cm long, with 3–5 second flowers, peduncles (from lowest flower down) 7–17 mm long, stout, terete, densely rusty tomentose; bracts ovate or elliptic, 6–7 × 2.5–3 mm, rusty velvety hairy; buds broadly ellipsoid, 1.4–1.6 × 1.4–1.9 cm. Flowers (old ones only seen) 3.2–3.5 cm diameter; sepals elliptic to obovate, rounded or obtuse at apex, concave, 1.3–1.7 × 0.9–1.1 cm, coriaceous, stiff, densely villous or tomentose outside with rusty hairs, glabrous and shiny inside; petals broadly obovate, 2-lobed at apex, 1.2–1.4 × 1–1.8 cm (imperfect ones only seen), deciduous; disc villous; stamens 30–50, all placed on one side of the carpels in rows; filaments ± united at base, linear, 1.5–2 mm long; anthers narrowly obloid, 3.5–4 mm long; staminodes 14–31, on outside of stamens, 3–4 mm long, linear or narrowly elliptic, acute at apex; carpels 2, densely villous or hairy only towards apex, ovules 2 per carpel; style glabrous. Seeds 1 or 2 per carpel, obovoid, 4–5 × 3–4 mm, brown, enveloped by a thin pale lobed aril. **Fig. 1A–G.**

Selected specimens: Queensland, COOK DISTRICT: N of Laura R. near Earlyman site, May 1975, *Byrnes* 3303 (BRI); Giant Horse Gallery, Laura, Mar 1975, *Hyland* 8115 (BRI); upper reaches of Garden Ck, east of Laura-Maytown Rd, Jul 1990, *Bean* 1767 (BRI).

Distribution and habitat: Common around Laura, far northern Queensland (Map 1); usually among sandstone outcrops.

H. laurana is easily distinguishable by its spikes of very large second flowers, rounded apex of its sepals, and broad, dentate, hairy leaves. It is similar to *H. banksii*

but differs chiefly in its large flowers and rounded apices of the elliptic-obovate sepals. The leaves are broader and also more dentate in *H. laurana* and the indumentum on the inflorescences and on the lower surface of the leaves are much paler than that in *H. banksii*.

Etymology: The specific epithet is taken from the locality viz Laura, where this species is quite common.

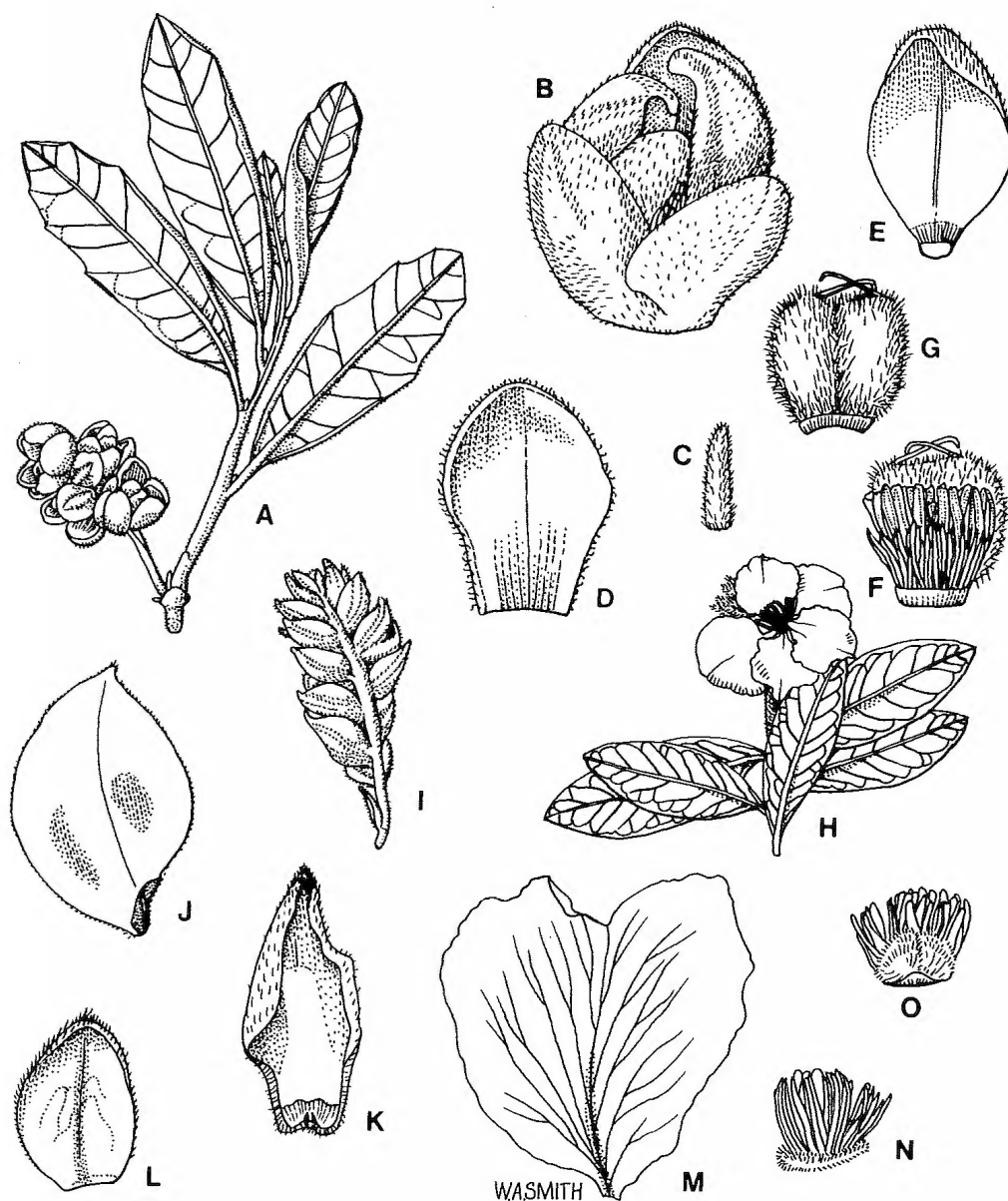


Fig. 1. A-G. *Hibbertia laurana*: A. flowering branch $\times 0.5$. B. flower $\times 2$. C. bract $\times 3$. D. outer sepal $\times 2$. E. inner sepal $\times 2$. F. stamens, staminodes and carpels $\times 2$. G. carpels $\times 2$. H-O. *Hibbertia arnhemica*: H. flowering branch $\times 0.5$. I. spike $\times 0.5$. J. bract $\times 2$. K. outer sepal $\times 2$. L. inner sepal $\times 2$. M. petal $\times 2$. N. stamens $\times 2$. O. carpels and stamens $\times 2$. A-G, Bean 1767; I, Lazarides 7571; H, J-O, Lazarides 7858.

3. *Hibbertia arnhemica* S. Reyn. sp. nov. *H. banksiae* (R. Br. ex DC.) Benth. et *H. lauranae* S. Reyn. affinis a quibus imprimis differt bracteis multo majoribus late ovatis, foliis margine integris non recurvis. **Typus:** Northern Territory. Arnhem Land, east of Mt Howship near East Alligator R., 12°36'S, 133°19'E, 8 July 1972, M. Lazarides 7571 (holo: BRI).

Erect shrubs to 1 m tall, bark pale grey; young parts pale rusty tomentose with pale or whitish short curved hairs, intermingled with long straight hairs; branchlets stout, terete, densely hairy with tight crispate hairs as well as long spreading fine hairs. Leaves ovate or elliptic, (5-)6.3-7.1 × (1.6-)3-4.5 cm, apex acute, subacuminate or obtuse, mucronate; base obtuse, subtruncate or acute; margins entire, flat, rarely slightly recurved; very discolorous, ± rigid, upper surfaces drying grey green, glabrous or hairy on midrib, lower ones whitish, densely tomentose with white hairs, lateral nerves and reticulate venation rusty brown hairy; lateral nerves 8-10 pairs, slightly oblique; reticulate venation prominent; petioles 0.5-3 mm long, hairy. Spikes terminating branchlets, 7.8-11.5 cm long, with 8-15 closely arranged secund flowers; peduncles stout, ± terete, 1.1-2.7 cm long (from the lowest flower down), densely crispate hairy; bracts very conspicuous, ovate-elliptic or broadly to narrowly ovate, acuminate, 1.3-2.1 × 0.8-1.5 cm, keeled, velvety. Buds ovoid, 1.8-2.3 × 1-1.2 cm. Flowers 3.4-4.5 cm diameter; sepals ovate or narrowly ovate, acute or acuminate, 1.5-2.3 × 0.7-1 cm, concave, ± rigid, densely rusty villous outside, glabrous inside; outer sepals larger than inner ones, slightly keeled; petals obovate, 2-lobed at apex, 1.8-2.3 × 1.5-2.2 cm, entire; disc villous; stamens 20-30, placed on one side of carpels, 4.5-8 mm long; filaments free, linear, 1.5-3 mm long; anthers narrowly obloid, 3-5 mm long; staminodes 8-15, inserted on outside of the stamens, 5-7 mm long, narrowly elliptic; carpels 2, densely villous; ovules 2 or 3 per carpel; style 2.5-3.5 mm long, glabrous; seeds 1 per carpel, obovoid, to 6.5 × 5.5 mm, with a cupular, lobed, pale aril towards its base. **Fig. 1H-O.**

Selected specimens: Northern Territory. Upper East Alligator R., 12°38'S, 133°26'E, Aug 1990, Menkhurst 986 & 987 (DNA); 3 miles [4.8 km] upstream from Jim Jim Falls, 13°12'S, 132°47'E, Jul 1977, Byrnes 2726 (BRI, DNA); Jim Jim Ck, 3.5 km ESE of Jim Jim Falls, May 1980, Lazarides 8940 (DNA); about 12 miles [19.2 km] E of El Sharana Mine, 13°20'S, 132°32'E, Feb 1973, Lazarides 7858 (BRI).

Distribution and habitat: Arnhem Land, Northern Territory, between East Alligator R. and Jim Jim Falls (**Map 1**); on sandstone plateau, usually in permanently wet deep sandy soil in eucalypt woodlands.

H. arnhemica is distinguishable by its large flowers with conspicuous large ovate bracts, inflorescences with secund flowers, and entire, very discolorous leaves. It is allied to *H. banksii* and *H. laurana* but differs essentially from both by its entire leaves and much larger bracts.

Etymology: The specific epithet refers to the region viz Arnhem Land, where this species is endemic.

B. *Hibbertia stricta* (R. Br. ex DC.) Benth. and allies

Amongst the variability noted under *H. stricta* is *H. hendersonii*. These species have stamens on one side of the carpels but no staminodes and are referable to section *Pleurandra* (Labill.) Benth. (1863, p. 18).

4. *Hibbertia hendersonii* S. Reyn. sp. nov. *H. strictae* var. *hirtiflorae* Benth. accedens sed habitu erecto, foliis longioribus, staminibus numerosis (20-31, raro 12), et sepalis multo majoribus. **Typus:** Queensland. LEICHHARDT DISTRICT: Blackdown Tableland about 35 km SE of Blackwater, altitude 600-900 m, 3 September 1971, R.J. Henderson H934, L. Durrington & P. Sharpe (holo: BRI; iso: BRI).

Erect shrubs to 1 m high, usually multi-stemmed; branchlets terete or slightly angular towards their tips, usually densely hairy with fine, long, slightly stiff spreading hairs, intermingled with shorter ones. Leaves suberect to patent, very narrow and elongate, narrowly elliptic, (21-)28-45 × 1-3 mm, apex subacute, mucronate; margins revolute; base subacute; both surfaces usually densely hairy with fine spreading hairs; midrib raised below, ± sunken above; petioles to 1 mm long. Flowers 2.5-2.8 cm diameter, sessile, solitary, axillary or terminating branchlets, 1-21 per branchlet with the terminal one the oldest; bracts narrowly ovate, 3-7 × 1-2 mm. Buds ellipsoid or ovoid, acuminate. Sepals ovate, abruptly acuminate, (8-)10-14 × 5-7 mm, apex recurved, outer sepals densely

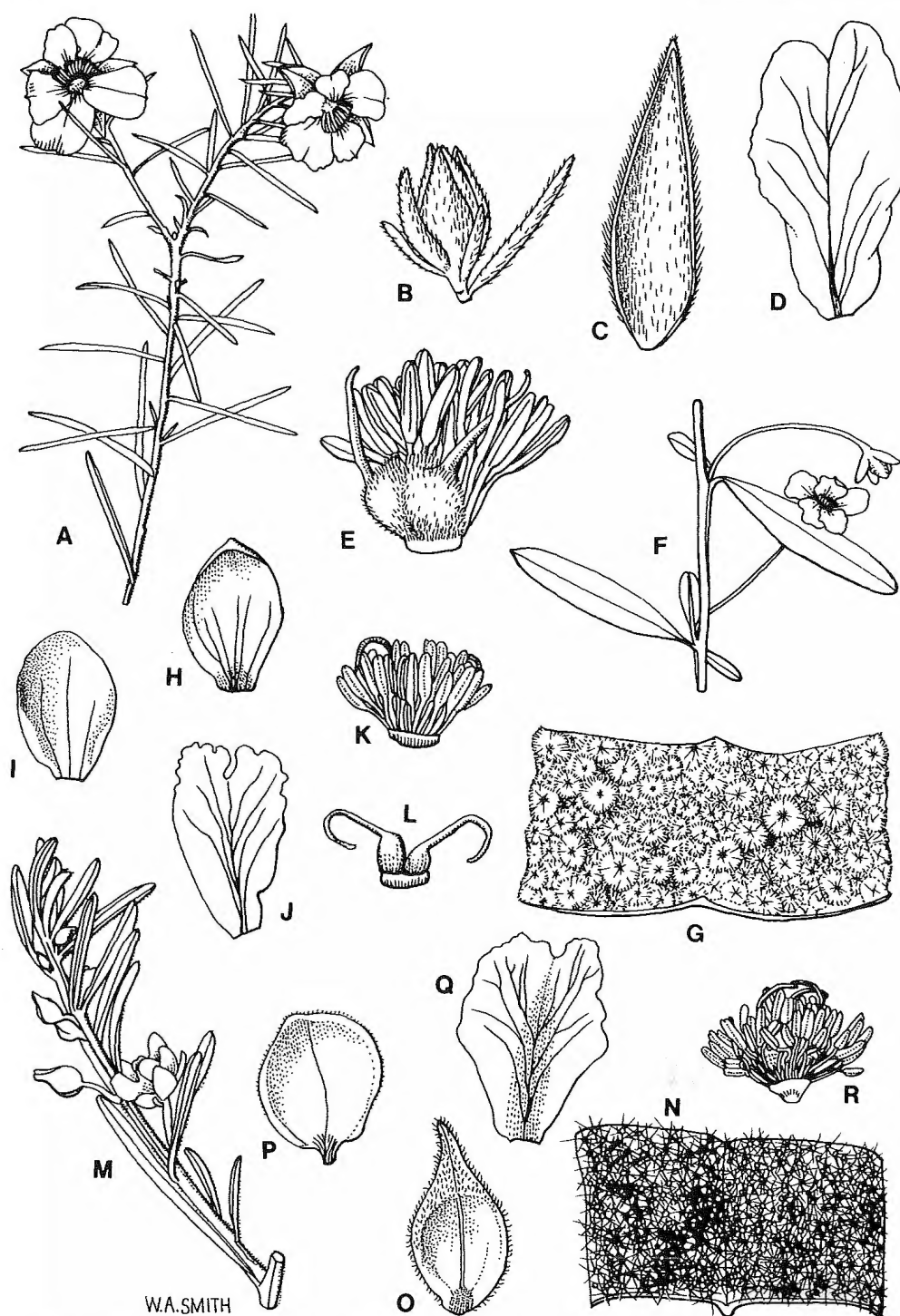


Fig. 2. A-E. *Hibbertia hendersonii*: A. flowering branch $\times 1$. B. bud $\times 2$. C. sepal $\times 4$. D. petal $\times 4$. E. stamens and carpels $\times 4$. F-L. *Hibbertia pholidota*: F. flowering branch $\times 1$. G. portion of leaf showing scales $\times 8$. H. outer sepal $\times 4$. I. inner sepal $\times 4$. J. petal $\times 4$. K. stamens $\times 4$. L. carpels $\times 4$. M-R. *Hibbertia mulligana*: M. flowering branch $\times 1$. N. portion of leaf showing stellate hairs $\times 8$. O. outer sepal $\times 4$. P. inner sepal $\times 4$. Q. petal $\times 4$. R. stamens $\times 4$. A-E, Henderson H934, Durrington & Sharpe; F-L, Warrian 5060; M-R, Clarkson 5307.

white hairy all over outside and towards the distal half inside, with long fine hairs intermingled with short hairs; inner sepals usually glabrous, ciliate; petals obovate, emarginate, entire, 12–14 × 8–10 mm; stamens 20–31, rarely 12, placed on one side of the carpels; filaments free, filiform, 1.5–2 mm long; anthers 2–3 mm long, narrowly obloid; carpels 2, densely sericeous, ovules 10–12 per carpel; styles 3–6 mm long, glabrous. Seeds 3–7 per carpel, ± reniform, to 2 × 1 mm, with small pale campanulate aril at its base. **Fig. 2A–E.**

Selected specimens: Queensland. LEICHHARDT DISTRICT: Blackdown Tableland, 1st creek, Aug 1964, *Gittins* 931 (BRI); ditto, on northern edge, Nov 1972, *Johnson & Blaxell* 876 (BRI); ditto, track to Stony Ck, Aug 1980, *Williams* 80189 (BRI).

Distribution and habitat: Common on Blackdown Tableland, central Queensland (**Map 2**); in sandy soil in open eucalypt forests; altitude 600–900 m.

H. hendersonii is recognisable by its erect stems, long linear leaves with very revolute margins, and fairly large flowers in axil of upper leaves. It approaches *H. stricta* var. *hirtiflora* Benth. but differs from it in its erect habit, longer leaves, greater number of stamens (20–31 (rarely 12) in number per flower), and by the larger sepals. *H. stricta* var. *hirtiflora* is a smaller plant with decumbent, sparsely hairy stems, smaller leaves and flowers, and also fewer stamens (12–17 in number). The leaves and sepals of the latter are also sparsely and finely hairy.

Etymology: The species is named in honour of Mr R.J.F. (Rod) Henderson (BRI), one of the collectors of the type, who recognised this plant as a distinctive new species.

C. New species of *Hibbertia* section *Hibbertia* (Andrews) Benth. (1863, p. 19)

Among the new species in this section are *H. cymosa*, *H. mulligana*, *H. oligodonta* and *H. pholidota*. These species have stamens all around the carpels. *H. oligodonta* has sessile flowers and glabrous carpels and is referable to series *subsessiles* Benth. (1863, p. 20); while *H. cymosa*, *H. mulligana* and *H. pholidota* have pedunculate flowers and scaly carpels and are referable to series *tomentosae* Benth. (1863, p. 19).

5. *Hibbertia oligodonta* S. Reyn. sp. nov. *H. diffusae* R. Br. ex DC. aspectu maxime similis praecipue differt caulibus plerumque erectis, et indumento piliorum dense crispatorum, *H. lineari* R. Br. ex DC. et specierum affinium affinis, praecipue differt foliis paucidentatis. **Typus:** Queensland. LEICHHARDT DISTRICT: Bauhinia Downs – Rolleston Rd, about 20 miles [32 km] W of Bauhinia Downs, 31 August 1964, *R.W. Johnson* 2806 (holo: BRI).

Low, compact, erect, multi-stemmed shrubs to 1 m high, sometimes with ± straggly branches; branchlets ± terete, young ones densely crispate hairy, older ones ± glabrous. Leaves occasionally clustered on short branchlets, obovate or obovate-cuneate, rarely narrowly elliptic-obovate, 14–28(–50) × 6–14(–25) mm; apex obtuse or subtruncate, mucronate, sometimes retuse; margins denticulate or dentate usually in the distal half with 1–4 teeth on each side of the midrib, very rarely entire; base cuneate, decurrent into short petioles; both surfaces usually densely crispate hairy, lower surfaces usually glaucous; midrib mostly drying reddish brown; lateral nerves obscure; petioles 1.5–3 mm long, flattened, articulate near base. Flowers 2.3–3.4 mm diameter, sessile, solitary, terminating short branchlets, subtended by young leaves; bracts ovate-triangular, 4–7 × 1–1.5 mm, finely hairy outside with long white hairs. Buds ellipsoid. Sepals broadly elliptic, 7–10 × 5.5–8 mm, slightly keeled and apiculate at ± rounded apex, concave, glabrous except sparsely crispate hairy margins; inner sepals larger than the outer ones; petals obovate-cuneate, 9–15 × 9–13 mm, slightly emarginate, entire; stamens 22–38, all placed around the carpels; filaments free, filiform, 2.5–3 mm long; anthers as long as filaments, narrowly obloid, obtuse; carpels 3, glabrous; ovules 2 per carpel; styles 4–4.5 mm long. Seeds 1 or 2 per carpel, subglobose, 2–2.5 × 2.5 mm, brown, with a small pale deeply lobed aril at its base. **Fig. 3A–F.**

Selected specimens: Queensland. LEICHHARDT DISTRICT: Salvatore Rosa National Park, Oct 1981, *Cockburn* 31 (BRI); Blackdown Tableland about 32 km SE of Blackwater, on Mimosa Ck, Apr 1971, *Henderson* H588, *Andrews & Sharpe* (BRI); ditto, Sep 1970, *Williams* 79087 (BRI); Shotover Ra., 60 miles (97 km) ENE of Springsure, Sep 1961, *Lazarides & Storey* 45 (BRI).

Distribution and habitat: Common on and around Blackdown Tableland, central Queensland (Map 1); in sandstone ridges, rocky outcrops, in sandy soil amongst sandstone rocks, usually in open eucalypt forests; altitude 600–700 m.

H. oligodonta is distinguishable by the sparsely toothed leaves and crispate hairy erect stems. It is at first sight very similar to *H. diffusa* with which it had been confused in the past, but differs from it mainly in the dense crispate hairs on the erect stems (in *H. diffusa* the stems are usually decumbent and the hairs are straight and spreading). It is closely related to *H. linearis* and its allies, but the leaves are usually entire in those species.

Etymology: The specific epithet refers to the few-toothed (*oligo* (Greek), few; *dontus* (Greek), toothed) margins of the leaves.

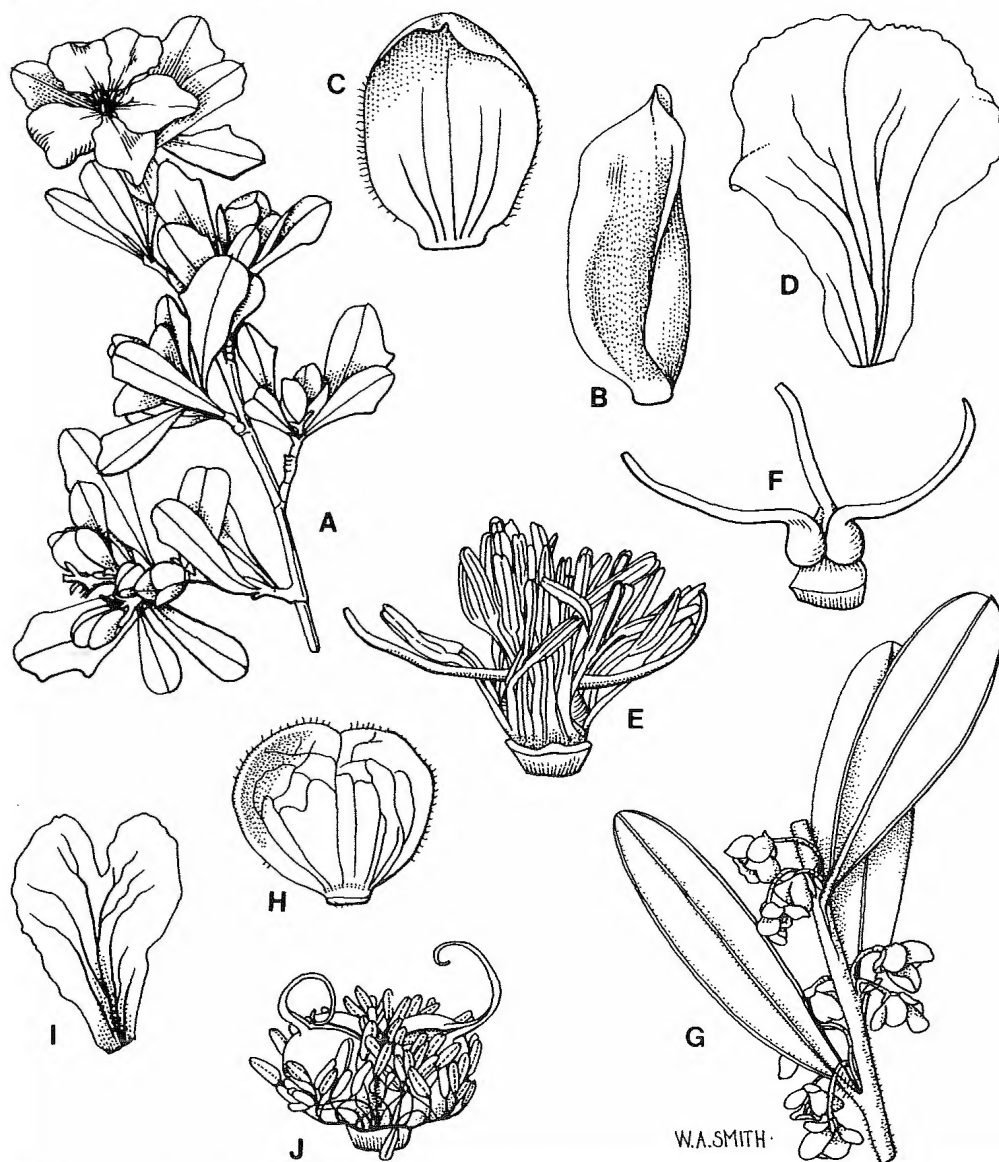


Fig. 3. A–F. *Hibbertia oligodonta*: A. flowering branch $\times 1$. B. outer sepal $\times 4$. C. inner sepal $\times 4$. D. petal $\times 4$. E. stamens $\times 4$. F. carpels $\times 4$. G–J. *Hibbertia cymosa*: G. flowering branch $\times 1$. H. sepal $\times 4$. I. petal $\times 4$. J. stamens and carpels $\times 4$. A–F, Johnson 2800; G–J, Bean 1713.

6. *Hibbertia mulligana* S. Reyn. sp. nov. *H. melhanioidi* F. Muell. affinis praecipue differt, foliis multo angustioribus, anguste ellipticis, margine revolutis, et sepalis exterioribus conspicuis, multo majoribus, late ovatis. **Typus:** Queensland, COOK DISTRICT: Mt Mulligan, 16°54'S, 144°51'E, alt 750 m, 12 April 1984, J.R. Clarkson 5307 (holo: BRI; iso: BRI,K,L,MEL,MO,NSW,QRS,PERTH).

Subshrubs to 1 m high, with erect or rarely decumbent stems; usually with loose bark; branchlets terete or $\pm$ 4-angular towards their tips and slightly keeled, densely stellate hairy with long hairs, older ones $\pm$ glabrous. Leaves narrowly elliptic or subobovate-elliptic, (20–)32–45 $\times$ 2.5–5.5 mm; apex obtuse; margins entire, recurved; base acute, narrowing and decurrent into short petioles; both surfaces stellate hairy, hairs denser below; midrib sunken above, raised below; lateral nerves patent, sometimes distinct below; petioles 1.5–2.5 mm long, densely stellate hairy. Flowers solitary, axillary, 1.2–1.5 cm diameter, long pedunculate; peduncles filiform, dilated at their tips, 1.2–3 cm long, densely stellate hairy; bracts narrowly elliptic to clavate, 4–7 $\times$ 0.5–2 mm, densely stellate hairy. Buds ovoid, acuminate. Sepals unequal, outer ones larger than the inner ones, usually broadly ovate-elliptic, abruptly acuminate, attenuate, (7–)9–11(–13) $\times$ 4–6 mm, keeled especially in the distal half, densely stellate hairy outside and towards apex inside, the hairs usually with scale-like bases; inner sepals elliptic, obtuse, concave, 6–7 $\times$ 4–5 mm, densely hairy outside with short or long stellate hairs with scale-like bases, margins pale, ciliate; petals obovate, bilobed at apex, undulate, 8–10 $\times$ 7–10 mm; stamens 70–74, all placed around the carpels; filaments free, filiform, 1.7–2 mm long; anthers narrowly obloid, retuse, 1.7–2.5 mm long; carpels 3, densely hairy with stellate hairs with scale-like bases, ovules 3 or 4 per carpel; styles glabrous, 3.5–4 mm long. Seeds (immature ones only seen) 3 or 4 per carpel, obovoid. **Fig. 2M–R.**

Selected specimens: Queensland, COOK DISTRICT: Mt Mulligan, Apr 1984, Clarkson 5307 (BRI); ditto, Mar 1986, Walker (BRI); ditto, Apr 1989, Neldner 2759 (BRI).

Distribution and habitat: Around Laura and Mt Mulligan, northeastern Queensland (**Map 2**); in sandstone scree slopes and escarpments; altitude 660–750 m.

H. mulligana is easily recognisable by its very narrow leaves with revolute margins, long pedunculate flowers; broadly ovate acuminate keeled outer sepals, densely stellate hairy stems and leaves. It is allied to *H. melhanioides* of which it has the solitary pedunculate flowers, but the leaves are much broader (more than 10 mm wide), the margins flat or slightly recurved, outer sepals narrowly ovate and stamens fewer (22–40 per flower) in *H. melhanioides*.

Etymology: The specific epithet is derived from Mt Mulligan, where this species was first collected and is quite common.

7. *Hibbertia cymosa* S. Reyn. sp. nov. insignis inflorescentis cymosis, 2- vel 3-floribus, a speciebus nobis notis bene distincta. Accedit *H. melhanioidi* F. Muell. quoad aspectu, formam foliorum et indumentum sed ab ea differt sepalis suborbicularis lepidotis, et staminibus numerosis (52–80 numero variantibus). **Typus:** Queensland, COOK DISTRICT: Sandy Creek area NE of Jowalbinna, 15°43'S, 144°18'E, 4 July 1990, A.R. Bean 1713 (holo: BRI; iso: BRI).

Erect shrub to 1.4 m high; branchlets and leaves densely stellate hairy with long whitish hairs; branchlets terete. Leaves obovate or obovate-elliptic, (2.8–)4.1–6 $\times$ (0.9–)1.2–1.8 cm, apex obtuse shortly mucronate or slightly retuse; base acute narrowing into short petiole; margins entire, slightly recurved, upper surfaces dark green, sparsely stellate hairy, lower ones whitish, densely stellate hairy; midrib sunken above; lateral nerves indistinct, $\pm$ patent, looping at margins; petioles 2–4 mm long. Inflorescences cymose, shortly pedunculate, axillary or supra-axillary, 2- or 3-flowered; bracts elliptic or elliptic-ovate, 2–5.5 $\times$ 1–1.5 mm, stellate hairy, foliaceous. Buds globose. Flowers 1.2–1.6 cm diameter; pedicels 6–11 mm long, filiform, scaly or with a few stellate hairs with scale-like bases; bracteoles ovate, obtuse, 1–1.5 $\times$ 1–1.25 mm, ciliate, scaly outside, often papillose inside; sepals suborbicular or elliptic, rounded at apex, concave, scaly outside, glabrous inside; outer sepals narrow, 4–4.5 $\times$ 3.5–4 mm; inner ones broad, 5–7 $\times$ 5.5–6.5 mm; petals obovate, 2-lobed at apex, 7–8 $\times$ 6–7 mm, entire; stamens 52–80, all placed around the carpels; filaments united at base, filiform, 2.5–3 mm long; anthers narrowly ellipsoid, about 1 mm long; carpels 2, densely scaly outside, ovules 2 per carpel;

style glabrous. Seeds 1 or 2 per carpel, subglobose, $2-2.5 \times 2-2.5$ mm, shiny, brownish, with a thin cupular lobed aril at its base. Fig. 3G-J.

Distribution and habitat: Known only from the type (Map 3); growing beside creek with *Lophostemon suaveolens* and *Dillenia alata*.

H. cymosa is distinguishable from other species that I have seen from Queensland by its few flowered (2- or 3-flowered) cymose inflorescences. It is also distinguishable by its densely hairy stems and leaves, and densely lepidote sepals and carpels. It approaches *H. melhanioides* in its aspect, leaf shape and indumentum but differs in the suborbicular lepidote sepals and numerous stamens (52-80 in number). The sepals are narrowly ovate, and stamens fewer (22-40 per flower) in *H. melhanioides*.

Etymology: The specific epithet refers to the cymose inflorescence.

8. *Hibbertia pholidota* S. Reyn. sp. nov. *H. lepidotae* R. Br. ex DC. affinis a qua imprimis differt foliis fere duplo latoribus oblongis vel ellipticis, apice obtusissimis, retusis vel emarginatis. **Typus:** Queensland. NORTH KENNEDY DISTRICT: Hinchinbrook Island, Deluge Inlet, north branch 3.5 km from mouth, 7 June 1977, A. & M. Thorsborne 520 (holo: BRI).

Scaly trailing shrubs with usually procumbent branchlets to 2 m high; branchlets triquetrous especially towards their tips; stems, leaves, petiole, sepals and peduncles densely covered with large, shiny or scarious peltate scales. Leaves oblong or elliptic-oblong, $(1.6-2.7-5.7 \times 0.6-1.2)$ cm; apex obtuse and apiculate, or retuse or emarginate, often slightly recurved; margins entire, flat or slightly recurved; base obtuse; upper surfaces green, densely scaly with scarious shiny scales, or scaly only towards the midrib, or glabrous and with only a row of scales along the margins; lower surfaces silvery, densely covered with scarious shiny scales; midrib $\pm$ sunken above; lateral nerves indistinct, $\pm$ patent, looping at margins; petioles 2-4.5 mm long. Flowers 1.2-1.7 cm diameter, solitary, axillary, long pedunculate; peduncles filiform, dilated towards the apex, 1.4-4 cm long, sparsely scaly; bracts ovate, $1-3 \times 1-1.5$ mm, densely scaly. Buds $\pm$ globose. Sepals broadly elliptic, concave; outer sepals $4-5 \times 2.5-3$ mm, densely scaly outside, glabrous inside; inner sepals $5-6 \times 3.5-4.5$ mm, densely scaly outside except the pale margins; petals obovate, bilobed at apex, $7-7.5 \times 5-6$ mm, entire or crenulate; stamens 30-39, all placed around the carpels; filaments free, filiform 1-1.5 mm long; anthers narrowly obloid, to 1.5 mm long; staminodes absent; carpels 2, densely scaly; style 3 mm long, glabrous; ovules 2 per carpel. Seeds solitary in each carpel, subglobose, to 2×3 mm, reddish brown, with a small membranous campanulate lobed aril at its base. Fig. 2F-L.

Specimens examined: Queensland. NORTH KENNEDY DISTRICT: Hinchinbrook Island, Mar 1986, Warrian 5060 (BRI); ditto, NE slopes of Mt Diamantina, Aug 1951, Blake 18856 (BRI); ditto, Zoe Bay, Oct 1982, Tracey 15486 (BRI); ditto, southern end of Little Ramsay Bay, Aug 1975, Sharpe 1733 (BRI); 27 km south of Cardwell, 220 m west of Bruce Highway, May 1970, Thorsborne & Thorsborne 226 (BRI).

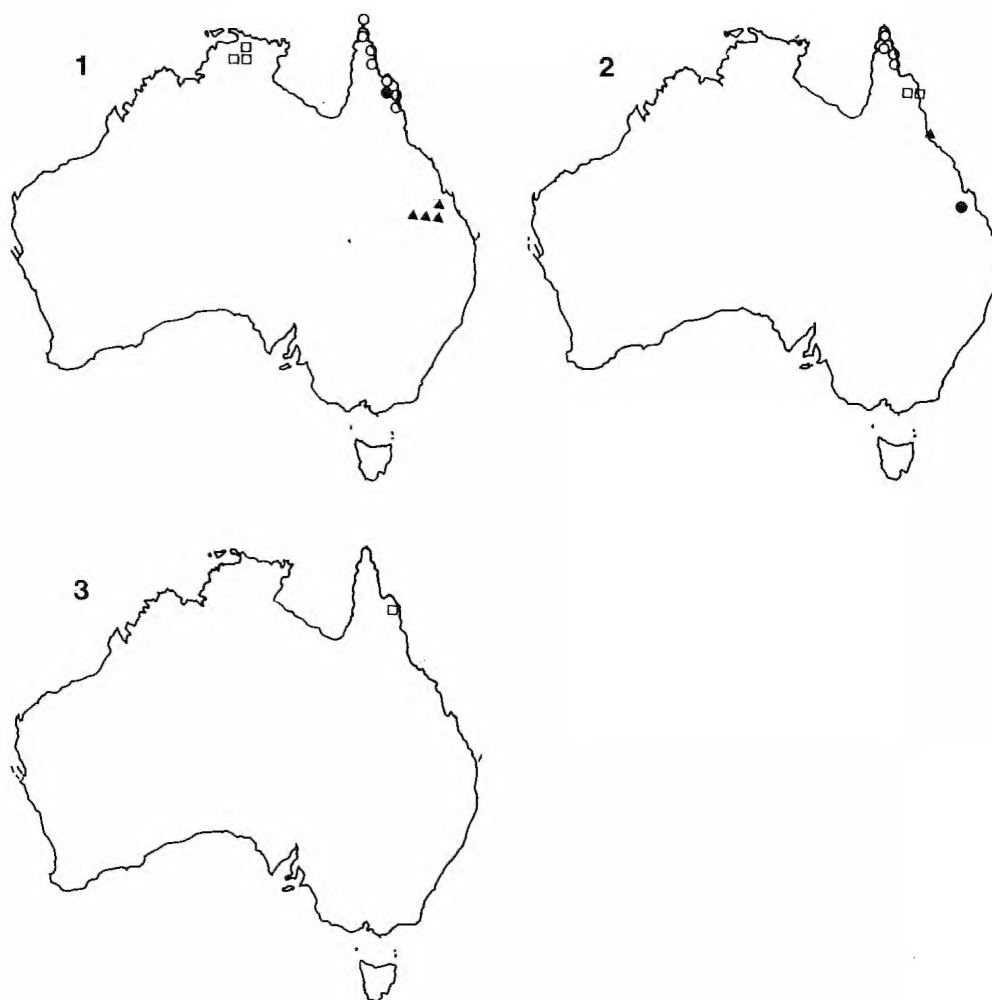
Distribution and habitat: North Queensland, near Cardwell and at Hinchinbrook Island where it is common (Map 2); usually along creeks in sandy soil creeping over rocks.

H. pholidota is distinguishable by the shiny scales on the leaves, stems, peduncles and sepals, and by its broad, obtuse, usually oblong leaves, and very angular (triquetrous) young branchlets. It is allied to *H. lepidota* R. Br. ex DC. of which it has the shiny scales, but leaves are very narrow, acute, flat or $\pm$ concave, and densely scaly, and stamens fewer (less than 18 per flower) in *H. lepidota*.

Etymology: The specific epithet refers to the scales (*pholidotos* (Greek), scaly) on the plant.

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Maps 1-3. Distribution of *Hibbertia* spp.: 1. *H. arnhemica* □; *H. banksii* forma *banksii* ○; *H. laurana* ●; *H. oligodonta* ▲. 2. *H. banksii* forma *rigidula* ○; *H. hendersonii* ●; *H. mulligana* □; *H. pholidota* ▲. 3. *H. cymosa* □.

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ADDITIONS TO *SECAMONE* R. BR. (ASCLEPIADACEAE: SECAMONOIDEAE) IN AUSTRALIA

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Summary

Four species of *Secamone* R. Br., *S. elliptica* R. Br., *S. lineata* Blume, *S. auriculata* Blume and *S. timoriensis* Decne. are recognised as occurring in Australia. The status of the genus *Toxocarpus* Wight & Arn. is discussed and its placement in the synonymy of *Secamone* is supported.

Introduction

A revision of *Secamone* R. Br. in Australia wherein a single species, *S. elliptica* R. Br. was recognised, was given by Forster and Harold (1989). Although the author was aware at the time of completion of that paper that several taxa of Apocynales from northern Australia possibly belonged to *Secamone* or to other genera, the lack of fertile material prevented unequivocal placement of these specimens either in the Apocynaceae or Asclepiadaceae.

Examination of several fertile collections held at PERTH and a range of material from L has enabled identifications to be made of this material. This has resulted in the recognition of three additional taxa of *Secamone* for Australia. Two of these taxa were transferred to *Toxocarpus* Wight & Arn. by Decaisne (1844) and Boerlage (1890) after being originally described as species of *Secamone* (Blume 1826). The third species, *S. timoriensis*, was originally described as a species of *Secamone* (Decaisne 1844), but the name has subsequently not been used.

Toxocarpus has been maintained as distinct from *Secamone* by a number of authors (e.g. Decaisne 1844; Tsiang 1939; Bakhuizen van den Brink 1950) primarily on the basis of the elongated style-head of *Toxocarpus* as opposed to the capitate to obtuse style-head of *Secamone*. Style-head elongation would appear to be a trivial character upon which to distinguish genera within the Asclepiadaceae, as it is possible for the style-head to vary from depressed-globose to capitate or even elongate-rostrate, within different populations or subspecies of the same species, e.g. some species of *Hoya* and *Marsdenia*. When other characters are enumerated for species of *Secamone* s. str. and *Toxocarpus* s. str. (Decaisne 1844), there are no further characters whereby the two genera can be maintained as distinct. Hence the placement of *Toxocarpus* in the synonymy of *Secamone* as a section by Schumann (1897) is supported here.

Over sixty species of *Toxocarpus* (Tsiang 1939) have been described from Asia and Malesia and the group is in need of critical study. Many of the earlier names of authors such as Blume and Decaisne do not seem to have been subsequently applied to taxa and the group is poorly collected. Variation within species, as with most Asclepiadaceae, further complicates the situation and it is likely that there are considerably fewer, widespread and variable taxa than the large number of published epithets would indicate. However many more collections are required of these Malesian taxa before their taxonomy can be reviewed.

Four species of *Toxocarpus* were described from New Guinea by Schlechter (1914). I have not been able to locate any type material of these taxa as the holotypes at B were destroyed in World War 2 (B. Leuenberger, pers. comm.), however the possibility of isotype material in other European herbaria cannot be ruled out at this stage. As a result the possibility of conspecificity with the Australian and Javan taxa cannot be determined at present. On the basis of the herbarium material seen from Australia and Java, *T. cyclocephalus* Markgraf (isotype at BRI) would appear to be endemic to New Guinea; however, the status of the taxa described by Schlechter (1914) is unclear. The present identifications of the Australian material are based on overall similarity with the Javan material on inflorescence and floral morphology and in particular leaf venation where the collections are sterile. The names used in this treatment are the earliest valid names applicable.

The inclusion of these three additional taxa for Australia does not require any additions to the generic description for *Secamone* (Forster & Harold 1989), but as bibliographic information for *Toxocarpus* was not given in that account, this has been added here.

Taxonomic Treatment

Secamone R. Br., Prodr. 464 (1810).

Refer to Forster & Harold, *Austrobaileya* 3: 69–78 (1989) for typification, a generic description and bibliographic material.

Toxocarpus Wight & Arn. in Wight, Contrib. bot. India (1834); *Secamone* section *Toxocarpus* (Wight & Arn.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 263 (1897). **Type:** *T. kleinii* Wight & Arn., lecto, *fide* Tsiang, *Sunyatsenia* 4: 66 (1939).

Decne. in DC., Prodr. 8: 504–506 (1844); Benth. in Benth. & J.D. Hook., Gen. pl. 2: 505 (1876); J.D. Hook., Fl. Brit. India 4: 13–15 (1885); Tsiang, *Sunyatsenia* 4: 65–87 (1939).

Goniostemma Wight, Contrib. bot. India 62 (1834). **Type:** *G. acuminatum* Wight Decne. in DC., Prodr. 8: 504 (1844).

Schistocodon Schauer, Nov. Acta Acad. Nat. Cur. 19, Suppl. 1: 362 (1843); *Toxocarpus* section *Schistocodon* (Schauer) Tsiang, *Sunyatsenia* 4: 66 (1939). **Type:** *S. meyenii* Schauer Decne. in DC., Prodr. 8: 677 (1844).

Genianthus J.D. Hook., Fl. Brit. India 4: 15 (1885). **Type:** not designated.

Rhynchosigma Benth. in Benth. & J.D. Hook., Gen. pl. 2: 771 (1876); *Toxocarpus* section *Rhynchosigma* (Benth.) Tsiang, *Sunyatsenia* 4: 76 (1939). **Type:** *Rhynchosigma racemosum* Benth., lecto, *fide* Bullock, Kew Bull. 15: 194 (1961). Benth., Hook. Icon. pl. 12: 77–78 (1876).

Key to sections present in Australia

1. Style-head not greatly exceeding anthers, obtuse to capitate **Secamone**
Style-head greatly exceeding anthers, conical-elongate
. **Toxocarpus** (Wight & Arn.) K. Schum.

Floral descriptions are based on collections from Java and New Guinea, supplemented by fertile Australian material where available. Indumentum cover is described using the terminology of Hewson (1988), except that 'scattered' is used instead of 'isolated'.

Key to the species of *Secamone* in Australia

1. Leaf lamina membranous and without extrafloral nectaries at base; WA, NT, QLD, NSW 1. ***S. elliptica***
Leaf lamina coriaceous and with extrafloral nectaries at base 2
2. Secondary venation prominently raised below; extrafloral nectaries 30–40 at lamina base; QLD 2. ***S. auriculata***
Secondary venation discernible, but not prominently raised below; extrafloral nectaries 2–8 at lamina base 3
3. Leaf lamina with 13–16 secondary veins per side of midrib; QLD 3. ***S. lineata***
Leaf lamina with 6–9 secondary veins per side of midrib; WA 4. ***S. timoriensis***

1. *Secamone elliptica* R. Br.

See Forster & Harold, *Austrobaileya* 3: 70–72 (1989) for typification details, a description and illustrations.

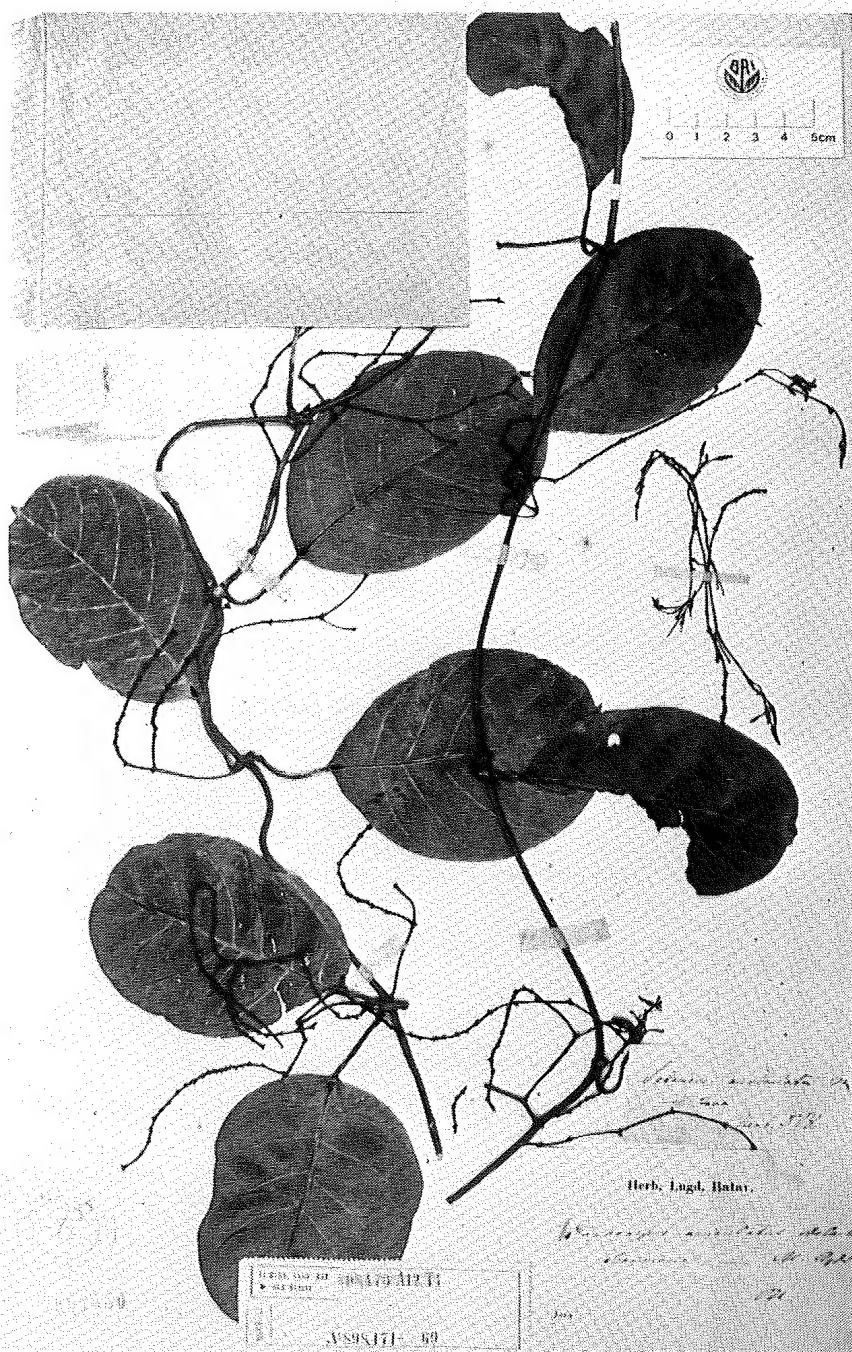


Fig. 1. *Secamone auriculata*: representative sheet of holotype series (L898171-69).

2. *Secamone auriculata* Blume, Bijdr. 1051 (1826); *Toxocarpus auriculatus* (Blume) Decne. in DC., Prodr. 8: 505 (1844). Type: Java, Blume (holo: L898171-67, L898171-70, L898171-69).
Backer & Bakhuizen van den Brink, Fl. Java 2: 255 (1965).

Vine to several metres, latex white. Stems cylindrical, up to 2 mm diameter, glabrous or with sparse to dense brown indumentum when young, becoming lenticellate with age; internodes up to 11 cm long. Leaves petiolate; lamina elliptic, up to 15 cm long and 10 cm wide, discolorous; above dark green, venation obscure, with scattered brown indumentum; below pale green, secondary veins 6 per side of midrib, tertiary venation obscure, with sparse brown indumentum particularly on veins; tip mucronate; base cuneate; petiole grooved along top, 28–31 mm long, 1–1.5 mm wide, with short sparse indumentum; extrafloral nectaries 30–40 at lamina base and extending to 3 mm up lamina midrib. Cyme with many fascicles, up to 16 cm long; peduncle up to 3 cm long and c. 1 mm wide, with scattered indumentum; bracts lanceolate-ovate, c. 1 mm long and 0.75 mm wide, with scattered indumentum. Flowers rotate, c. 2 mm long, 9–10 mm wide; pedicels c. 11 mm long and 0.5 mm wide, with scattered to sparse brown indumentum. Sepals lanceolate-ovate, c. 2 mm long and 1 mm wide, with sparse indumentum. Corolla probably cream; tube c. 1 mm long and 3 mm diameter; lobes lanceolate, 8–11 mm long and c. 1.2 mm wide, glabrous. Staminal corona c. 1.2 mm diameter; each lobe erect, recurved, narrowly linear, slightly broadened at top, c. 0.8 mm long and 0.3 mm wide. Staminal column c. 1 mm long and 0.8 mm diameter; anther appendages lanceolate-ovate, 0.8–1 mm long, 0.5–0.6 mm diameter; slit between anther wings 0.2–0.3 mm long. Style-head conical-elongate, 0.8–1 mm long, 0.5–0.6 mm diameter. Pollinarium 0.27–0.28 mm long, 0.14–0.21 mm wide; pollinia narrow-oblong, c. 0.16 mm long and 0.07 mm wide; corpusculum triangular, 0.06–0.07 mm long, 0.07–0.08 mm wide; caudicles linear, c. 0.05 mm long and 0.01 mm wide. Follicles and seed not seen. Fig. 1.

Specimens examined: Java. [L898171-75] (L); [L898171-71] (L); [L898171-73] (L). Australia. Queensland. COOK DISTRICT: Moa Is, Torres Strait, 10°11'S, 142°16'E, *Budworth* 1020 (BRI).

Distribution and habitat: Recorded from Java and from Torres Strait, Australia. The Moa Island plants are probably from a vineforest community.

Notes: The collection of *Budworth* 1020 is sterile; however, vegetatively it is a close match for the type material of *S. auriculata* and is quite dissimilar to the other Australian taxa. The pollinaria of this species are different to those of the other species and to those illustrated by Tsiang (1939), as the caudicles are well developed and the junction between the two pollinia attached to each caudicle is indistinct, if indeed it exists at all. However other floral features of *S. auriculata* fit the concept of *Secamone* as applied herein. As the material dissected was very old and fragmentary, further fresh or spirit material is required before any decisions on the generic placement of this species can be resolved.

Conservation status: Further field work is required to adequately assess the size of the population of this species in Australia. An appropriate conservation coding at this stage is 2K +, using the system developed by Briggs and Leigh (1988).

3. *Secamone timoriensis* Decne. in DC, Prodr. 8: 502 (1844). Type: Timor, *Riedle* (iso: P, n.v., photo BRI!).

Vine to several metres, latex white. Stems cylindrical, up to 2 mm diameter, with dense red indumentum in 2 lines spiralling up the stem; internodes up to 13 cm long. Leaves petiolate; lamina elliptic to elliptic-obovate, up to 9 cm long and 4.5 cm wide, discolorous; above glossy dark green, venation obscure, with scattered to dense indumentum; below pale green, secondary veins 7–9 per side of midrib, tertiary venation reticulate, with dense indumentum, particularly on veins; tip mucronate; base rounded; petiole grooved along top, 13–15 mm long and c. 1 mm wide, with dense red indumentum; extrafloral nectaries 2–8 at lamina base. Cyme with up to 10 fascicles, up to 5 cm long; peduncle 1–4 mm long and 1 mm diameter, splitting immediately into 2 branches, with dense red indumentum; bracts lanceolate to elliptic-ovate, 1.3–2 mm long, 0.7–1 mm wide, with dense red indumentum. Flowers campanulate, 4–7 mm long, 7–10 mm diameter; pedicels 1.5–2 mm long and c. 0.25 mm diameter, with dense red indumentum. Sepals lanceolate-ovate, 2.2–3 mm long and c. 1.5 mm wide, slightly overlapping, with sparse

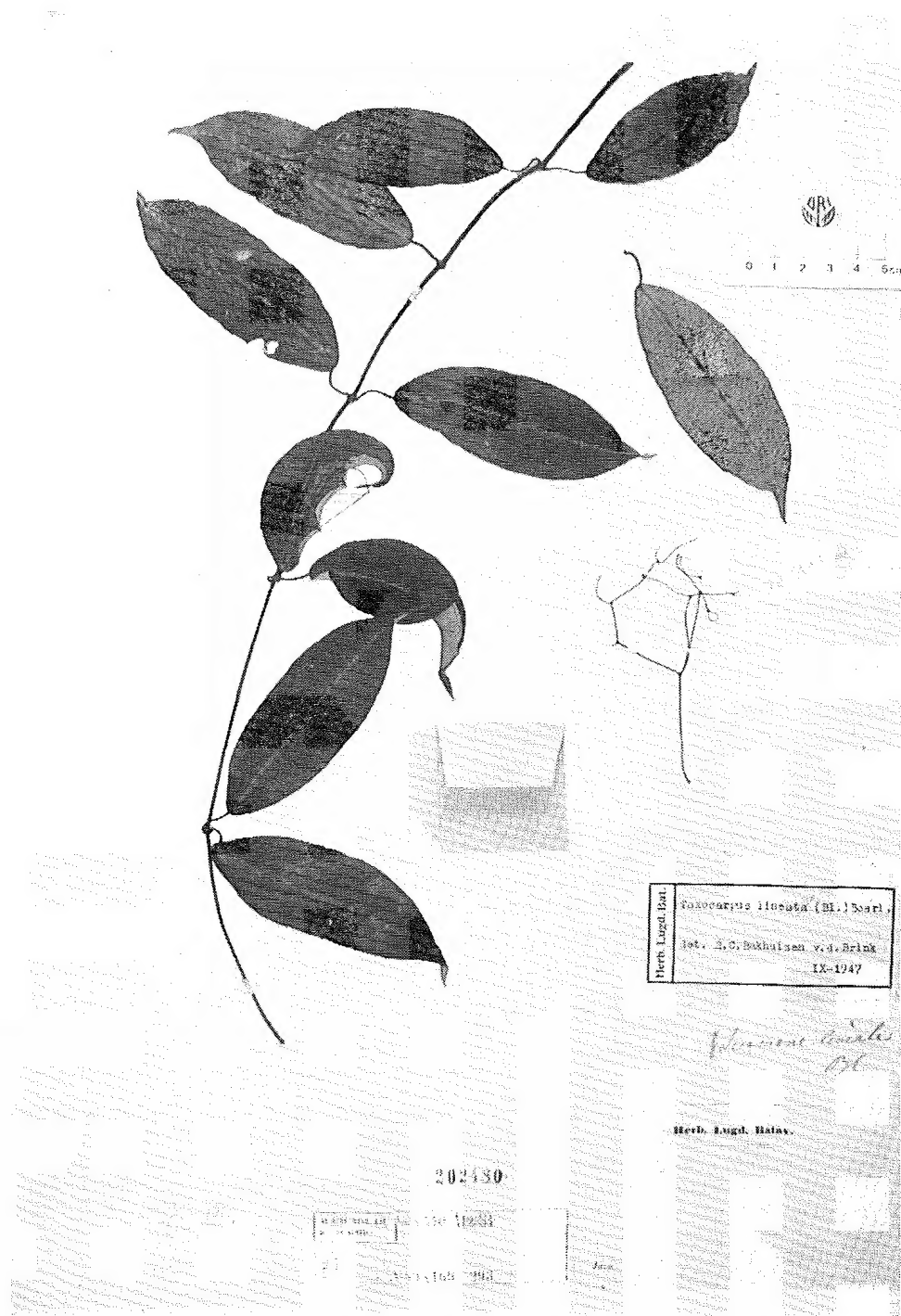


Fig. 2. *Secamone lineata*: representative sheet of holotype series (L898169-297).

to dense red indumentum externally; bases of sinuses with 1 or 2 glands. Corolla yellow; tube 2–3 mm long, 2.5–3 mm diameter, externally glabrous, internally with sparse indumentum in throat; lobes lanceolate, twisted to right in bud, 4.6–6 mm long and c. 2 mm wide, glabrous. Staminal corona c. 1.5 mm long and 1.5 mm diameter; each lobe attached to bottom of staminal column, lanceolate, c. 1.5 mm long and 0.75 mm wide, truncate at top. Staminal column 1.3–1.5 mm long, 1–1.3 mm diameter; anther appendage triangular to obtuse, 0.25–0.5 mm long, 0.25–0.3 mm wide; slit between anther wings c. 0.9–1 mm long. Style-head conical-elongate, exceeding anthers, 2.4–2.5 mm long and c. 0.8 mm wide at base. Ovaries c. 0.6 mm long and 0.5 mm wide. Pollinarium c. 0.25 mm long and 0.15 mm wide; pollinia 0.13–0.15 mm long, 0.06–0.08 mm wide; corpusculum c. 0.08 mm long and 0.06 mm wide. Follicles fusiform, c. 11 cm long and 8 mm wide, glabrous; seed not seen.

Specimens examined: Irian Jaya. Cycloop Mtns, road Hollandia – Sentani, Lake Sentani, Jun 1961, *van Royen & Sleumer* 5804 (L). Australia. Western Australia. Lone Dingo, Mitchell Plateau, 14°35'S, 125°45'E, Feb 1979, *Beard* 8447 (PERTH); Surveyors Ck road, turnoff between Mitchell Plateau Mining Camp and Port Warrender road, 14°39'S, 125°42'E, May 1981, *Tracey* 14002 (BRI, QRS); Forest Ck near Drysdale River, 14°39'S, 126°57'E, Aug 1975, *George* 14123 (PERTH); Mertens Falls (Little Falls) on road to Mitchell Falls, Mitchell Plateau, 14°48'S, 125°42'E, May 1981, *Tracey* 14008 (BRI, QRS); Glider Gorge, Carson Escarpment, Drysdale N.P., 14°49'S, 126°49'E, Aug 1975, *George* 13664 (PERTH); Worriga Gorge, Drysdale River N.P., 15°02'S, 126°40'E, Aug 1975, *George* 14023 (PERTH); 3.7 km NW of Mt Daglish, 16°15'S, 124°56'E, Jun 1987, *Keighery & Alford* 1378 (PERTH); Gorge of Barker River, NW of Mt Mattau, Mt Hart Stn, 16°46'S, 124°55'E, Jun 1987, *Edinger* s.n. (PERTH); Walsh Pt, Port Warrender, Admiralty Gulf, Jan 1980, *Kenneally* 7820 (PERTH); Mongonai Ck, 24 km S of Carson River Crossing, Gibb River – Kalumburu Mission road, Jun 1976, *Beaughole* 52087 (PERTH); Cape Clujo, Jul 1973, *Wilson* 11286 (PERTH).

Distribution and habitat: Recorded from Timor and Western Australia, Australia. Plants grow as lianes in vine thickets.

Notes: Of the Australian material cited, only *Beard* 8447 and *Kenneally* 7820 are fertile and there is considerable vegetative variation between the other collections. Further fertile collections are required to determine whether more than one taxon is involved.

Conservation status: This species seems to be quite common in the Kimberleys in Western Australia. No conservation coding is required.

4. *Secamone lineata* Blume, Bijdr. 2: 1050 (1826); *Toxocarpus lineatus* (Blume) Boerl., Handl. fl. Ned. Ind. 2: 436 (1890). **Type:** Java, *Blume* (holo: L898169–297, L898169–293).
Decne. in DC., Prodr. 8: 503 (1844); Backer & Bakhuizen van den Brink, Fl. Java 2: 256 (1965).

Woody vine to several metres, latex white. Stems cylindrical, up to 2 mm diameter, glabrous or with scattered indumentum when young, becoming lenticellate when old; internodes up to 13 cm long. Leaves petiolate; lamina lanceolate-ovate to elliptic, up to 12.5 cm long and 4.5 cm wide, discolorous; above glossy, dark green, venation obscure, glabrous; below pale green, secondary veins 13–16 per side of midrib, tertiary venation obscure, glabrous or with scattered indumentum on veins; tip acuminate; base rounded; petiole grooved along top, 11–13 mm long and c. 0.5 mm wide, glabrous or with scattered indumentum; extrafloral nectaries 4–5 at lamina base. Flower rotate, c. 3 mm long, 13–14 mm diameter; pedicels 12–14 mm long and c. 0.3 mm diameter, glabrous. Sepals lanceolate, c. 1.4 mm long and 0.7 mm wide, with sparse indumentum. Corolla probably yellow; tube c. 1.5 mm long and 2.5 mm diameter; lobes lanceolate, c. 7 mm long and 1.5 mm wide, glabrous. Staminal corona c. 2 mm diameter, comprising 5 lobes adnate to staminal column; each lobe subulate, c. 2 mm long and 0.4 mm wide. Staminal column c. 1.3 mm long and 1 mm wide; anther appendages truncate, c. 0.1 mm wide; slit between anther wings c. 0.4 mm long. Style-head conical-elongate, c. 1.4 mm long and 0.3 mm diameter. Pollinarium c. 0.27 mm long and 0.27 mm wide; pollinia c. 0.07 mm long and 0.07 mm wide; corpusculum c. 0.08 mm long and 0.05 mm wide. Follicles and seed not seen. **Fig. 2.**

Specimens examined: Sumatra. [L898169–294] (L). Java. [L898169–296] (L); ditto, [L898169–295] (L); ditto, [L898169–299] (L); ditto, [L908337–284] (L); Tepoes Lantjer, Tjadas Malang, Feb 1918, *Winckel* 70ß (L); Res. Preanger, Oct 1896, *Koorders* 26066ß (L); Res. Preanger, Tjigenteng, Jan 1897, *Koorders* 26355ß (L). Australia. Queensland. COOK DISTRICT: 2.7 km past Lockerbie Homestead site on road to Cape York, 10°47'S, 142°29'E, Jun 1988, *Forster* 4418 & *Liddle* (BRI, MEL, QRS); Lake Patricia, Weipa, 12°39'S, 141°50'E, Apr 1988, *Forster* 4077 & *Liddle* (BRI); Lamond Hill, 12°43'S, 143°18'E, Apr 1988, *Forster* 4213 & *Liddle* (BRI); Garraway Creek rockpiles, 12°45'S, 143°11'E, Apr 1988, *Forster* 4240 & *Liddle* (BRI); McIlwraith Range, 1962, *Webb & Tracey* 7981 (BRI).

Distribution and habitat: Recorded from Sumatra, Java and far north Cape York Peninsula, Queensland. The Australian populations grow in rainforests and vineforests on a variety of soil types.

Notes: Sterile plants may be recognised partly by the prominent lenticels on the stems which are uncommon in other Australian Asclepiadaceae. There is also a tendency for the stems to layer on contact with the soil. There is no available fertile Australian material of this taxon and the floral description is mainly based on *Koorders* 26355 β and [L898169–294]. Despite extensive searching during February and March 1990 in the wet season at Lockerbie Scrub and Weipa where this species is very common I was not able to locate flowering material or observe evidence of past flowering.

Conservation status: Although this species has been rarely collected in Australia, it is not uncommon on far north Cape York Peninsula and thus does not require a conservation coding.

Acknowledgements

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NOTES ON *GRAPTOPHYLLUM* NEES (ACANTHACEAE) IN AUSTRALIA

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Summary

A revised key to the species of *Graptophyllum* in Australia is given. The most important diagnostic characters for *Graptophyllum* in Australia are discussed. *Graptophyllum reticulatum* A. Bean & Sharpe sp. nov. from south-east Queensland is described. *G. thorogoodii* C. White is reduced to synonymy with *G. excelsum* (F. Muell.) Druce.

Introduction

A revision of the family Acanthaceae in Australia, including a review of the genus *Graptophyllum*, was published by R.M. Barker in 1986. In revising the genus, Barker was hampered by the few specimens available for study, some of which were sterile. This problem has now been partly remedied, as numerous collections have been made recently. This increase in herbarium material combined with field observations by the authors and others, allows us to clearly define the most important characters and circumscribe the species involved. The discussion below applies to Australian *Graptophyllum* material only.

Diagnostic Characters

Leaf characters

(a) **Arrangement:** For most species, a simple pattern of opposite leaves is the rule, but for one species, *G. excelsum*, condensed axillary branchlets occur, in addition to the normal phyllotaxis. Here several leaves are formed on very short side-branches and separated by very short internodes. This gives the appearance of a cluster of leaves at each node.

(b) **Size and shape:** Leaf shape, and to a lesser extent leaf size, are relatively consistent for each species. There is some overlap between species, but used in conjunction with other characters, leaf size and shape are useful diagnostic characters in species determination. The prominence or otherwise of marginal teeth is diagnostic. In *G. excelsum*, leaves are entire or slightly toothed, *G. spinigerum* is distinctly toothed, while the remaining species have long spinose marginal teeth. In fresh material of most species, the lateral veins are not readily visible, but *G. reticulatum* has prominent raised reticulation of leaf veins. *G. ilicifolium* displays this feature in dried material.

(c) **Pairs:** A feature of most *Graptophyllum* species is that the leaves at each node are unequal in size. In those species, the larger leaf is commonly more than five times the area of the smaller one. In *G. excelsum*, the one species which does not display this feature, the leaf pairs are about the same size.

Axillary spines

From field observations of all four species, we have found that axillary spines are consistently either present or absent for wild populations of each species. However, in the case of species where spines occur, they will not necessarily be evident on herbarium specimens. The axillary spines occur most often on older wood or coppice growth. Young, actively growing stems may be free from spines, hence cultivated plants seldom possess them. *G. reticulatum* never has axillary spines.

Flowers

Two species, *G. excelsum* and *G. ilicifolium*, have large (c. 30 mm long) red flowers, while *G. spinigerum* and *G. reticulatum* have small (c. 10 mm long) white flowers with mauve spots. The size and colour of flowers is consistent for each species. We can find

no evidence of the floral dimorphism which Barker (1986: 158) suggested could occur in *Graptophyllum*. Smaller "flowers" observable on specimens of the large-flowered species appear to be flower buds, in which the corolla has split prematurely in response to the drying of the specimen.

The number of flowers per leaf axil, length of calyx segments, and pedicel length were all found to be highly variable. Fruits are too rarely seen, either in the field or the herbarium, to be used for diagnostic purposes.

Key to the Australian species of *Graptophyllum*

1. Leaves 6–10 cm long, with spinose marginal teeth >2 mm long; reticulation of leaf venation raised in dried material 2
 Leaves 1.7–6 cm long, entire or with short marginal teeth <2 mm long; leaf venation obscure on dried material 3
2. Corolla white with mauve spots, 8–11 mm long; leaves 3–4.5 cm wide, lateral veins raised in fresh material *G. reticulatum*
 Corolla red, >25 mm long; leaves 3.5–5.5 cm wide, lateral veins not raised in fresh material *G. ilicifolium*
3. Leaf pairs approximately equal in size, margins entire or slightly toothed; corolla red, >25 mm long; condensed axillary branchlets present *G. excelsum*
 Leaf pairs greatly unequal in size, margins distinctly toothed; corolla white with mauve spots, 7–10 mm long; condensed axillary branchlets absent *G. spinigerum*

Taxonomic Treatment

***Graptophyllum reticulatum* A. Bean & Sharpe sp. nov.** affinis *G. spinigero* a qua floribus extus glabris, ramulis glabris, foliis aculeatidentatis valde retinervis, spinis axillaribus nullis differt. **Typus:** Queensland, MORETON DISTRICT: about 7 km SW of Nambour, 7 October 1989, P.R. Sharpe 4889 & A.R. Bean (holo: BRI; iso: AD,CANB,K,L,MEL,NSW).

A shrub, 1–2.5 m high, bark smooth, grey. Branchlets angular, glabrous, bark loose, axillary spines absent. Aerial roots sometimes present. Leaves opposite, leaf pairs markedly unequal in size. Larger leaves up to 10.5 × 4.5 cm, dark green above, paler below, glabrous, leathery, with 5–8 pairs of pungent marginal teeth; apex acute, spine-tipped; midrib impressed above; reticulation raised and very conspicuous on upper surface, main veins visible on lower surface; cystoliths very numerous, conspicuous; petioles about 2 mm long. Inflorescences small, dense axillary cymose clusters of 5–18 flowers on very short peduncles, each flower subtended by a pair of 2 mm long eglandular hairy bracteoles, at the base of the pedicel. Calyx segments 4–8 mm long, slender, glabrous outside, hairy inside. Pedicels 3–7 mm long. Corolla 8–11 mm long, white with mauve spots in the throat; externally glabrous, and internally glabrous apart from indumentum at point of filament insertion, and at apex of upper lip; limb 2-lipped, upper lip notched, convex, lower lip divided into 3 nearly equal lobes, recurved. Stamens two, brown, exserted; filaments hairy on lower half, anthers two-celled, brown, slender, parallel, glabrous, opening by slits, connective not extended; staminodes two, enclosed. Style with a few sparse hairs; stigma distinctly 2-lobed. Fruit a woody capsule, clavate, apically acute, 15–17 × 4 mm. Seeds not seen. **Fig 1.**

Specimens examined: Queensland, MORETON DISTRICT: near Dulong Road, west of Woombye, May 1989, Bean 1034 (BRI); ditto, Nov 1989, Bean 1192 (BRI,NSW); Brolga Park, west of Woombye, Feb 1990, Bean 1348 (BRI).

Distribution and habitat: This species is known from just two small populations about 1.5 km apart. About 100 plants occur at each site, growing in complex notophyll vine forest. Habitat varies from creekbank to hillside but in all cases, the ground is very rocky. Associated species include *Syzygium francisii* (Bailey) L. Johnson, *Hodgkinsonia ovatiflora* F. Muell., *Cryptocarya laevigata* Blume, *Bouchardatia neurococca* (F. Muell.) Baillon and *Dissiliaria baloghioides* F. Muell. ex Benth.

Flowering period: October – December.

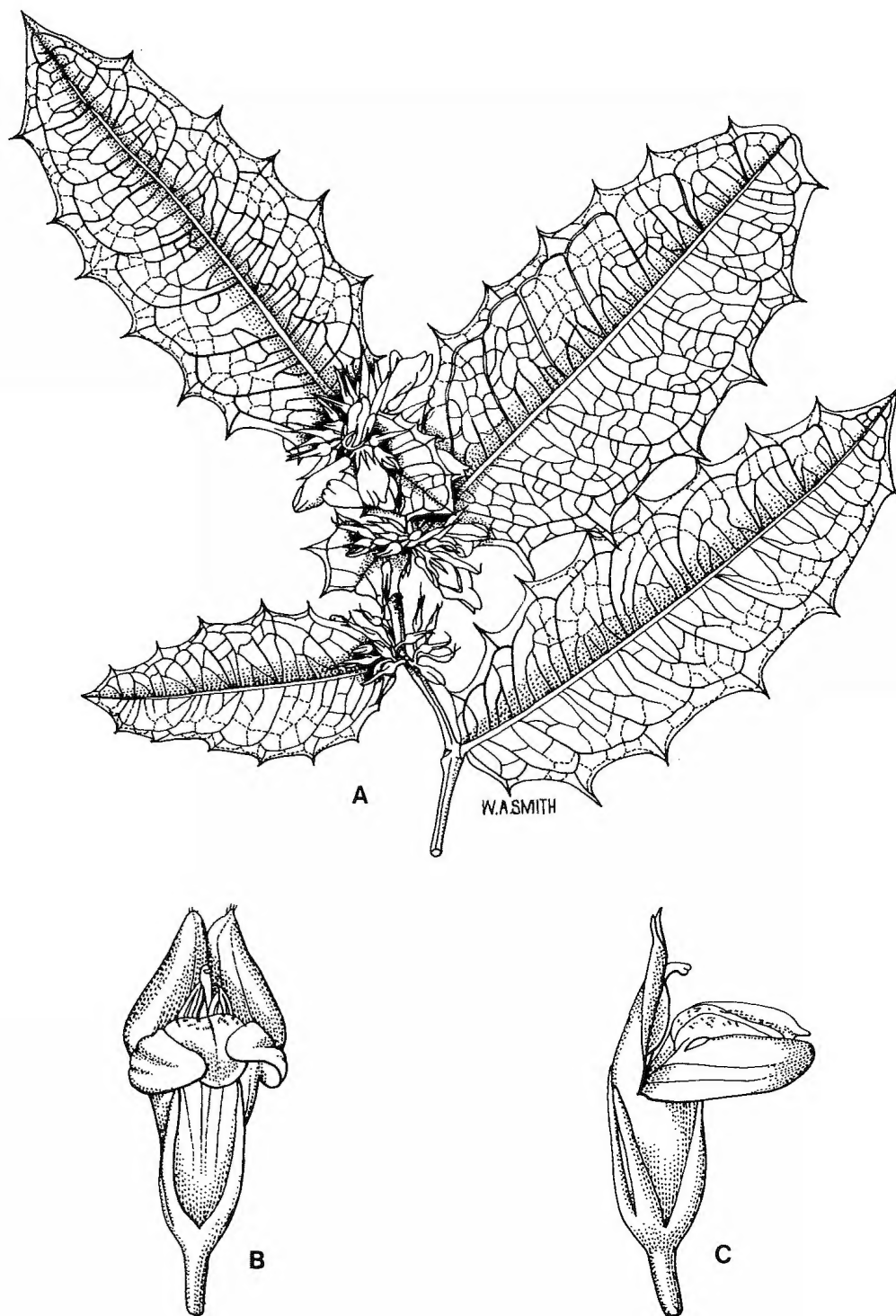


Fig. 1. *Graptophyllum reticulatum*: A. part of flowering twig $\times 1$. B. flower from front $\times 4$. C. flower from side $\times 4$.

Affinities: *G. reticulatum* is readily distinguishable from all other species of *Graptophyllum*.

(i) *G. excelsum* has large red flowers, leaves less than 4 cm long, leaf pairs which are approximately equal in size, and condensed axillary branchlets. None of these features is possessed by *G. reticulatum*.

(ii) *G. spinigerum* has the same size and colour flowers, but it has hairs on its branchlets, corolla (externally), calyx (externally), and anthers; while *G. reticulatum* does not. The leaves of *G. spinigerum* are smaller, and lack spinose teeth and raised leaf venation.

(iii) *G. ilicifolium* is vegetatively similar to *G. reticulatum*, but can be distinguished by its broader leaves, somewhat shorter marginal teeth and less conspicuous reticulate venation. The flowers of *G. ilicifolium* are red, and about 30 mm long.

G. ilicifolium, *G. spinigerum* and *G. excelsum* possess axillary spines, whereas *G. reticulatum* does not.

Conservation status: Being restricted to an area of about two hectares, *G. reticulatum* must be considered endangered, 2E, following the criteria used by Thomas and McDonald (1989).

Etymology: The specific epithet refers to the prominent reticulation of the leaf venation.

Graptophyllum ilicifolium (F. Muell.) F. Muell. ex Benth., Fl. austral. 4: 552 (1868); *Graptophyllum earlii* var. *ilicifolium* F. Muell., Fragm. 6: 87 (1867). **Type:** Port Mackay, Mount Blackwood, s. dat., *Nernst* (lecto: MEL), *fide* R.M. Barker, J. Adelaide Bot. Gard. 9: 163 (1986).

This species occurs as a tall shrub which grows on rocky gullies in complex notophyll vine forest in the Mackay district, where it is probably endemic. It is characterised by large red flowers (30–35 mm long) and large leaves (6–11 cm long and 4–5.5 cm wide) which possess long spinose marginal teeth. The leaf pairs are greatly unequal in size. Branchlets are glabrous. Axillary spines are present, but rarely seen on herbarium material. Condensed axillary branchlets are absent.

Specimens examined: Queensland, SOUTH KENNEDY DISTRICT: Mackay, S. dat. *Nugent* 64 s. dat. [AQ 006883] (BRI); Revenge Creek, on SW side of Mt Adder 12–15 km from Kuttabul, Jul 1984, *Champion* 71 & *Champion* (AD, BRI, CANB, NSW).

A specimen collected by Jones (BRI, AQ 007238) from Port Douglas and determined by Barker (1986) as either *G. spinigerum* or *G. ilicifolium*, is clearly *G. spinigerum* based on the small flowers and shallowly toothed leaves which lack raised reticulation.

Graptophyllum excelsum (F. Muell.) Druce, Bot. Soc. Exch. Club Brit. Isles, Rep. 1916: 625 (1917); *Earlia excelsa* F. Muell., Fragm. 3: 160 (1863); *Graptophyllum earlii* F. Muell., Fragm. 6: 87 (1867), nom. illeg.; *Thyracanthus earlii* F. Muell., Fragm. 6: 87 (1867), nom. inval. **Type:** Rockhampton, *Thozet* 75 (lecto: MEL), *fide* R.M. Barker, J. Adelaide Bot. Gard. 9: 161 (1986).

Graptophyllum thorogoodii C. White, Proc. Roy. Soc. Queensland 50: 83 (1939), **synon. nov.** **Type:** Kelsey Ck, near Proserpine, March 1937, *Thorogood* (holo: BRI).

G. excelsum is characterised by consistently large red flowers (about 30 mm long), small leaves (varying from 1.7 to 4 cm long), leaf margins entire or slightly toothed and leaf pairs of approximately equal size. Leaves may be completely glabrous (e.g. *Vavryn* 22, BRI) or slightly pubescent at base of midrib (e.g. *Hoy* 138, BRI). Condensed axillary branchlets are present and are usually evident on herbarium material. Axillary spines are present, but these are not always evident on herbarium specimens. For example, *Forster* 5120 & *Vavryn* consists of 2 sheets collected from the same plant. In material on one sheet, axillary spines are present, whereas in that on the other sheet, there are none. *G. excelsum* inhabits semi-evergreen vine thicket.

G. thorogoodii was described by White (1939) from a specimen collected at Kelsey Creek near Proserpine. In recent years, populations occurring in the Chillagoe area have also been ascribed to this species (Barker 1986). White, in his protologue, compared *G. thorogoodii* with *G. spinigerum*, and discussed the possibility that *G. thorogoodii* may "in the future be regarded as a variety or synonym" of that species, because of his supposition that *G. spinigerum* would be found to possess dimorphic flowers. We now

know that this is not the case, and that these two taxa are quite distinct. White did not compare *G. excelsum* with *G. thorogoodii*, nor even mention *G. excelsum*.

The type collection of *G. thorogoodii* comprises four separate pieces, and it has all the characteristics of *G. excelsum* listed above. One piece displays condensed axillary branchlets, and one piece has axillary spines. The calyces (7–8 mm) and pedicels (6–9 mm) of the type are longer than is usual for *G. excelsum* but we have found calyx and pedicel length to be among the most variable characters for *Graptophyllum*. Both calyx and pedicel appear to lengthen after flowering, as mentioned by Barker (1986, 157). The Chillagoe populations assigned to *G. thorogoodii* also possess the characteristics of *G. excelsum*, although they are more inclined to possess axillary spines.

To summarise, *G. thorogoodii*, either from the type locality near Proserpine, or Chillagoe, is indistinguishable from *G. excelsum* and hence they should be considered conspecific.

Recent collections (all BRI) not cited by Barker (l.c.): **Queensland.** COOK DISTRICT: 1.5 km past Mungana trucking yards, 17°06'S, 144°23'E, Mar 1988, *Forster* 3956; Royal Archway Cave, Mungana, 17°06'S, 144°24'E, Mar 1990, *Forster* 6528. PORT CURTIS DISTRICT: Mt Etna, 23°09'S, 150°27'E, Nov 1987, *Vavryn* 22; ditto, Jun 1989, *Forster* 5120 & *Vavryn*; Mt Archer road, 23°21'S, 150°35'E, Jul 1987, *Hoy* 138; 2 km SE of Butlerville, northern end of Mt Larcom range, 23°46'S, 151°04'E, Jan 1988, *Forster* 3470 & *Gibson*.

Acknowledgements

We are grateful to Don and Fay McIntyre for their assistance and keen interest. Paul Forster provided valuable collections and observations. We must also thank Will Smith, Les Pedley, Irene Champion and Gordon Guymer for their help during the course of this project.

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NOTES

***Acacia pennata* (L.) Willd. subsp. *kerrii* I. Nielsen (Mimosaceae), a new record for Australia**

When preparing an account of *Acacia* subgenus *Aculeiferum* Vassal for the Flora of Australia a number of years ago, it was clear that amongst the material referred to *A. albizioides* Pedley was material of a second species from the tip of Cape York Peninsula. At the time only two specimens of this species were available and neither was in flower which made identification difficult. Fortunately Bruce Gray, Australian National Herbarium, Atherton (QRS), collected good flowering material between Bamaga and Lockerbie in February 1986 and it is this flowering material that finally enabled the species to be identified.

Perusal of the literature indicated that the species was likely to be either *A. pennata* (L.) Willd. or *A. megaladena* Desv. A specimen was sent to Dr T.D. Macfarlane at the Herbarium, Royal Botanic Gardens, Kew, who established its identity as *A. pennata* subsp. *kerrii* I. Nielsen, a taxon formally described in *Adansonia*, ser. 2, 19: 353 (1980).

Like *A. albizioides*, *A. pennata* is a vigorous liane with scattered recurved prickles on the branchlets. *A. pennata* is distinguished from *A. albizioides* at once by having leaves with more numerous pinnae pairs, more numerous pairs of smaller leaflets and very distinctive stipules. The large conspicuous longitudinally venose stipules act as bracts and envelop the young leaves and flower buds. The differential characters are indicated in the key below:

- | | |
|--|------------------------------|
| Leaves with 2-9 pinnae pairs; leaflets 16-28 pairs per pinna, 2-4 mm wide; stipules inconspicuous; pods 6-8 cm long | <i>A. albizioides</i> |
| Leaves with 9-20 pinnae pairs; leaflets 25-60 pairs per pinna, up to 1.5 mm wide; stipules conspicuous, up to 0.9 cm long, longitudinally venose; pods 14-16 cm long | <i>A. pennata</i> |

In Australia *A. pennata* subsp. *kerrii* is confined to the tip of the Cape York Peninsula where it occurs in or on the margins of rainforest, but the taxon occurs also in North East India, Burma, Cambodia, Laos, North and South Vietnam and the Lesser Sunda Island (Sumbawa and Timor).

Specimens examined: Queensland. COOK DISTRICT: Lockerbie, Hyland 21049V (QRS); Laradeenya Creek, Hyland 21051V (BRI,MEL,QRS); between Bamaga and Lockerbie, Gray 4299 (MEL,QRS).

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I am most grateful to the Director of the Queensland Herbarium and the Curator of the Australian National Herbarium, Atherton, for the loan of specimens, and to Dr T.D. Macfarlane, Australian Botanical Liaison Officer, Royal Botanic Gardens, Kew, for establishing the identity of the taxon.

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NOTES

***Ochrosia minima* (Markgraf) Fosberg & Boiteau (Apocynaceae), a new record for Australia**

While undertaking field collecting on far north Cape York Peninsula, Queensland, I encountered several populations of an unknown fruiting *Ochrosia* species (Apocynaceae). This taxon had been previously collected in Queensland a number of times and the collections had either remained undetermined or had been misidentified as *Neisosperma poweri* (Bailey) Fosberg & Sachet at the Queensland Herbarium. *N. poweri* does not occur on Cape York Peninsula but reaches its northern limit on the Atherton Tableland.

On examination of an isotype of *O. minima* (Markgraf) Fosberg & Boiteau from New Guinea, it was found that it matched the unknown *Ochrosia* sp. from Australia. *O. minima* was previously known only from the type collected in Papua New Guinea (Markgraf 1940, 1979). This new record brings the number of *Ochrosia* species native to Australia to three, of which only *O. moorei* (F. Muell.) F. Muell. ex Benth. is endemic.

***Ochrosia minima* (Markgraf) Fosberg & Boiteau**, *Adansonia* ser. 2, 17: 27 (1977); *Excavatia minima* Markgraf, J. Arn. Arb. 21: 199 (1940); *Bleekeria minima* (Markgraf) Merr. & Perry, J. Arn. Arb. 24: 214 (1943). **Type:** Papua New Guinea. WESTERN PROVINCE: Tarara, Wassi Kussa River, December 1936, L.J. Brass 8512 (holo: B, n.v.; iso: A, n.v.; BRI!). **Fig. 1.**

Illustration: Williams, Native Pl. Queensland 3: 231 (1987) [as *Ochrosia* sp.]

Specimens examined (all BRI). Australia, Queensland. COOK DISTRICT: Lake Boronto – Newcastle Bay, 10°45'S, 142°32'E, Sep 1974, Tracey 14341; Lockerbie Scrub, Cape York Rd, 5 km N of old "Lockerbie" (abandoned) homestead site, Sep 1985, Williams 85215; "Long Scrub", Bamaga district, Cape York, May 1962, Webb & Tracey 5972; Heathlands road, 11.3 km N of Captain Billy Landing turnoff, 11°02'S, 142°32'E, Jun 1988, Forster 4415 & Tucker; Jardine River N.P., 11°18'S, 142°36'E, Aug 1987, Fell 522; 3.5 km N of Captain Billy Landing turnoff, Heathlands to Bamaga road, 11°35'S, 142°33'E, Jun 1988, Forster 4500 & Tucker; N of Olive River, 12°07'S, 143°04'E, Sep 1974, Webb & Tracey 13728; N of Olive River, near mouth, 12°07'S, 143°05'E, Sep 1974, Tracey 14479; ENE flank of Mt Tozer, 12°45'S, 143°11'E, Oct 1986, Tucker 35; Mt Tozer, near Iron Range, 12°45'S, 143°12'E, Nov 1977, Tracey 14846; Hill E of Mt Tozer, Iron Range area, 12°45'S, 143°13'E, Nov 1977, Tracey 14214; Tozer Range, 0.5 miles [0.83 km] E of Mt Tozer, Jul 1948, Brass 19461; Head of Leo Ck above gorge, McIlwraith Range, 13°41'S, 143°23'E, Aug 1986, Fell 322.

Distribution and habitat: *Ochrosia minima* is found from the McIlwraith Range north to Cape York on Cape York Peninsula, Queensland, and in the southern part of Papua New Guinea (Map 1). It is a relatively common understorey shrub in evergreen notophyll vineforests on white sand-dune systems or on red acid volcanics.

Notes: In his 1979 account of *O. minima*, Markgraf cites the type (not specified as to holotype or isotype) as being at A. However, in the protologue (Markgraf 1940), the holotype is stated to be at B, and an isotype at A. While an additional thirteen collections for this species are now known, little can be added to the thorough descriptions given by Markgraf (1940, 1979).

In general appearance, *O. minima* closely resembles *O. moorei* (F. Muell.) F. Muell. ex Benth. from southern Queensland and northern New South Wales. However, it is conspicuously different from this southern species in the predominantly opposite leaves and the much smaller fruit. The three Australian taxa of *Ochrosia* may be distinguished with the following key.

1. Leaves 3- or 4-whorled, obovate-oblong to broadly elliptic; fruit subtriquetrous ***O. elliptica***
- Leaves opposite or 3- whorled, obovate-cuneate to lanceolate; fruit ellipsoid-rounded or ellipsoid-ovoid 2
2. Leaves opposite, very rarely 3-whorled; fruit ellipsoid-rounded, 1.5–1.6 cm long, 0.9–1 cm diameter ***O. minima***
- Leaves predominantly 3-whorled, very rarely opposite; fruit ellipsoid-ovoid, 6–7 cm long, 2.7–3 cm diameter ***O. moorei***

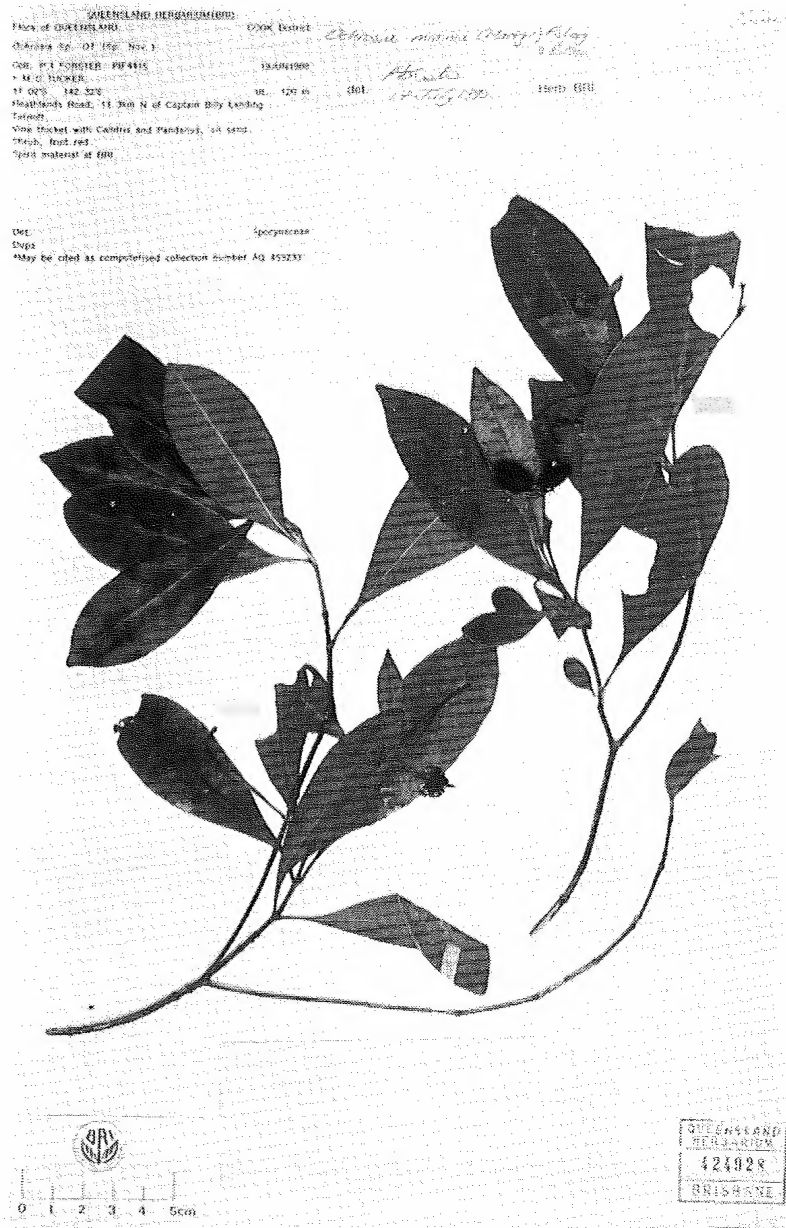
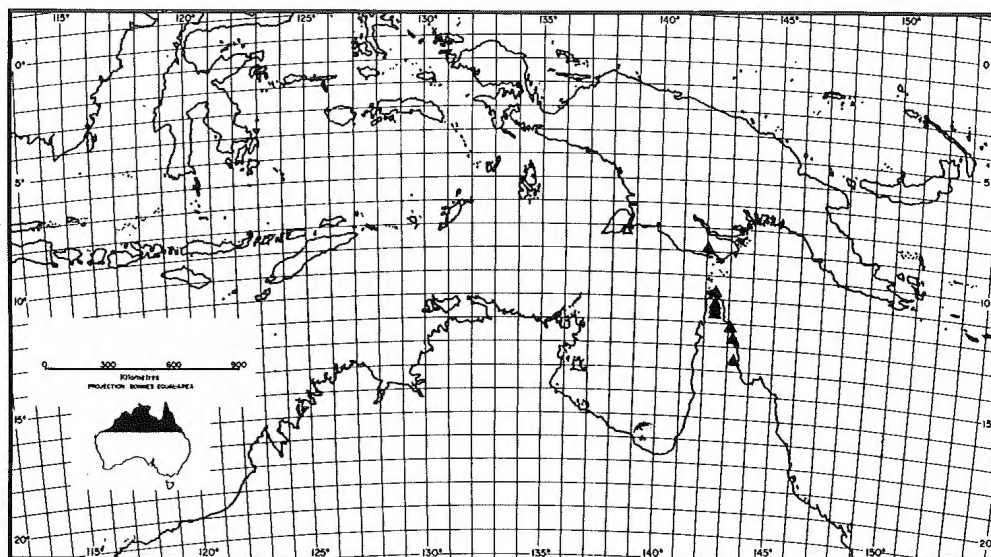


Fig. 1. *Ochrosia minima*. Forster 4415 & Tucker (BRI).



Map 1. Distribution of *Ochrosia minima* in New Guinea and northern Queensland.

Acknowledgements

The field assistance of G. Kenning, D.J. Liddle and M.C. Tucker is gratefully acknowledged. Field work was funded by the Australian Biological Resources Study during 1988–1990.

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NOTES

***Voacanga grandifolia* (Miq.) Rolfe (Apocynaceae), a new generic record from Torres Strait, Queensland, Australia**

A monographic account of *Voacanga* Thou. has been provided by Leeuwenberg (1985) who recognised 12 species. One of these species, *V. grandifolia* (Miq.) Rolfe, was recorded as having a wide distribution in Malesia. A recent fertile collection of *V. grandifolia* by B. Gray from Moa Island, Torres Strait, Queensland has enabled positive identification of earlier but fragmentary collections from Torres Strait that are also referable to this species. These collections represent a new generic record for the Australian flora.

***Voacanga grandifolia* (Miq.) Rolfe, J. Bot. 21: 202 (1883).**

Refer to Leeuwenberg, Agric. Univ. Wageningen Papers 85-3: 55-64 for a description, illustration, details of synonymy, typification and extra-Australian distribution.

Specimens examined: Australia. Queensland. COOK DISTRICT: Dauan Is, Torres Strait, 9°25'S, 142°30'E, Jul 1975, *Cameron* 2301 (QRS); Moa Is, Torres Strait at foot of Moa Peak N of St Paul's village, 10°10'S, 142°15'E, Jul 1986 *Harris* 202 (BRI); Banks (Moa) Is, Torres Strait, near St Paul's, 10°10'S, 142°15'E, Feb 1975, *Cameron* 20481 (QRS); Moa (Banks) Is, Torres Strait, 10°11'S, 142°20'E, Feb 1989, *Gray* 4989 (QRS);

Reference

LEEUEWENBERG, A.J.M. (1985). *Voacanga* Thou. *Agricultural University Wageningen Papers* 85-3: 5-80.

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NOTES

Zizyphus oligantha Merr. & Perry is a synonym of *Z. oenopolia* (L.) Mill. (Rhamnaceae)

Zizyphus oenopolia (L.) Mill. was originally described from material illustrated from Sri Lanka and has a wide distribution from Sri Lanka south through Malesia into New Guinea and northern Australia. In Australia, *Z. oenopolia* (L.) Mill. occurs in the top end of the Northern Territory and the far north of Cape York Peninsula in Queensland, and has been infrequently recorded from adjacent southern Papua New Guinea (Map 1).

Examination of material of *Z. oenopolia* in the Queensland Herbarium and of an isotype of *Z. oligantha* Merr. & Perry (Merrill & Perry 1939) found that the latter taxon was conspecific with the first. *Z. oligantha* is here formally reduced to synonymy of *Z. oenopolia*.

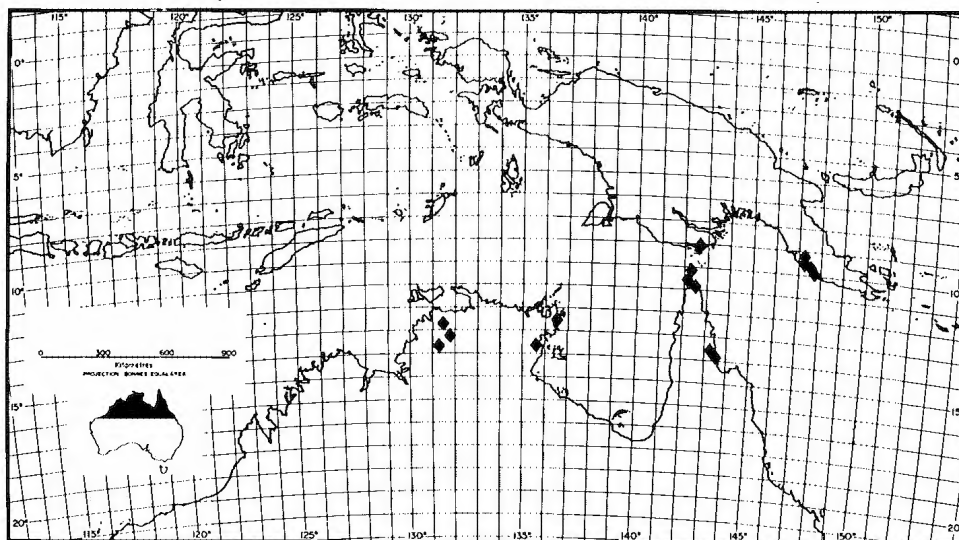
When Linnaeus (1753) named *Rhamnus oenopolia* L. he did not cite any specimens. However he did mention that the plant he was dealing with originated in Ceylon, and cited "Burm. zeyl. 131 t. 61". This plate is therefore selected lectotype for the name.

Most authors subsequent to Linnaeus, when mentioning this plant, have spelt the specific epithet as "oenoplia". However there seems no reason to maintain this error, despite its long standing in the literature.

Zizyphus oenopolia (L.) Mill., Gard. dict. ed. 8, n. 3 (1768); *Rhamnus oenopolia* L., Sp. Pl. 194 (1753). Type: J. Burm., Thes. zeyl. 131, t. 61 (1737) (lecto (here designated)). "Zizyphus oenoplia", DC., Prodr. 2: 21 (1825); Benth., Fl. austral. 1: 412 (1863); Bailey, Queensl. fl. 1: 268 (1899); Brock, Top End Native Pl. 337 (1988).

Zizyphus oligantha Merr. & Perry, J. Arnold Arb. 20: 338 (1939), **synon. nov.** Type: Papua New Guinea. WESTERN PROVINCE: Mabaduan, April 1936, L.J. Brass 6488 (iso: BRI!).

Selected specimens: Sri Lanka. CENTRAL PROVINCE: Kandy District, c. 1 mile W of Hunnagiriya, near mile post 20/11, Nov 1974, Davidse & Jayasuriya 8377 (BRI). Malaysia. PAHANG: Bukit Chemaga, Chegar Perak, Oct 1927, Henderson 19470 (BRI). Papua New Guinea. CENTRAL PROVINCE: Brown River road, near Terr. forest boundary, 9°10'S, 147°15'E, Jan 1967, Kairo & Streimann [NGF28000] (BRI); Near Mt Lawes, 9°10'S, 147°15'E, Mar 1971, Womersley [NGF43707] (BRI); Tavai Ck, 9°30'S, 147°20'E, Dec 1964, Gillison [NGF22100] (BRI). MILNE BAY PROVINCE: Rigo, Turner [AQ109979] (BRI). Australia. Northern Territory. NE Arnhem Land, 2 km NW Yirrkala, 12°14'S, 136°52'E, Feb 1988, Wightman 4148 (BRI); Beatrice Hill, 40 miles [66.7 km] SE of Darwin, Mar 1961, Chippendale [NT7928] (BRI); Mary River, 13°09'S, 131°51'E, May 1989, Dunlop 8391 & Wilson (BRI); Mary River, near Mt Bundey, Dec 1968, Byrnes 998 (BRI); Bennett Bay, Eastern Arnhem Land, 13°42'S, 135°52'E, Nov 1987, Russell-Smith 4226 & Lucas (BRI); 3 km W Mt Muriel, Tipperary, 13°54'S, 131°10'E Mar 1989,



Map 1. Distribution of *Zizyphus oenopolia* (L.) Mill. in Australia and New Guinea.

Russell-Smith 7952 & Brock (BRI). Queensland. COOK DISTRICT: Badu Is, Torres Strait, Jan 1980, Garnett 355 (BRI); Thursday Is, Jun 1897, Bailey 159 (BRI); Hammond Is, Jun 1897, Bailey 149 (BRI); Somerset, Jun 1897, Bailey 39 (BRI); Lockerbie, 10 miles [16 km] WSW of Somerset, Apr 1948, Brass 18398 (BRI); Lockerbie Scrub, 3 km past "Lockerbie" Homestead, 10°47'S, 142°29'E, Feb 1990, Forster 6330 (BRI,DNA,QRS); Upper Massey Ck, Oct 1962, Smith 11748 (BRI); On road between Peach Ck and Leo Ck, c. 30–40 miles [50–66.7 km] NE of Coen, 13°44'S, 143°15'E, Webb & Tracey 9883 (BRI).

Habitat: In Australia and southern Papua New Guinea, *Zizyphus oenopolia* grows on the margins of deciduous to semi-deciduous vineforest on red soils or may occur in adjacent savannah.

Acknowledgements

The various Directors of the Queensland Herbarium allowed access to collections. Field work at Cape York was incidental to Asclepiad collecting and was funded by the Australian Biological Resources Study.

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PLANT PROFILE

***Cyathea exilis* Holttum (Pteridophyta: Cyatheaceae)**

Cyathea exilis is a slender treefern discovered on Cape York Peninsula in 1983 by members of an Australian Orchid Foundation-sponsored expedition (Lavarack 1984), and described by R.E. Holttum in 1986. Neither the original publication nor the reference to the species in Appendix 2 of Andrews' Ferns of Queensland (1990) was accompanied by an illustration. This plant profile is intended to remedy that omission, and it also is dedicated to the memory of Prof. Holttum, who contributed so much to the taxonomy of the ferns, and to our knowledge of *Cyathea* in particular. Richard Eric Holttum died on 18 September 1990 at the age of 95.

In the description which follows, measurements enclosed in square brackets are those of the type description, where they differ from those of specimens examined by me. The discrepancies are considered to originate from the small number of specimens which have been collected.

***Cyathea exilis* Holttum**, Kew Bulletin 41: 532 (1986). **Type:** Queensland. COOK DISTRICT: Cape York Peninsula, William Thompson Range, Hann ['Mann'] Ck, growing with *Pandanus* and *Calamus* in swamp by the stream, September 1983, D.L. Jones *et al.* 1212 (holo: K, *n.v.*; iso: BRI!; CBG,NSW).

Trunk erect, to 2 [4] m tall and up to 4 [6] cm diameter (excluding basal root-mass), bearing proliferous buds, each bud in a more or less constant position in relation to an adjacent frond base. Stipes to 40 [20] cm long, rising vertically against the trunk for some distance, invested with narrowly conical spinules; spinules 0.5–1.5(–2.2) mm long, surmounted at their apices by narrow, deciduous, dark brown scales up to 1 cm long; stipe scales many cells thick near the base and $\pm$ peltately attached to the spinule, the scale margins pale, brittle and sparsely setose. Lamina 80–100 cm long, ovate, herbaceous, the basal pinnae reflexed in life and c. 21 [18] cm long, the largest pinnae to 31 cm long; rachises smooth below, with a few narrow, brown scales, grooved above, the groove densely clothed with brown, uniseriate hairs. Pinnules 5–5.5 cm long, 1.2–1.5 cm wide, deeply lobed, the lobes 2–3 mm wide, crenate, departing at an angle of 45–60° to the rachis, bearing up to 7 pairs of veins, these once forked for the most part in fertile pinnules; sterile pinnules usually slightly larger than fertile pinnules; rachises smooth, the upper surfaces clothed with hairs similar to those of the primary rachis, the lower surfaces with a few very narrow scales toward the base (the larger scales brown and apically setiferous, the smaller ones pale and not setiferous), with small, strongly bullate, pallid scales towards the apex of the pinnules and on the veinlets of the lobes. Sori, except the lowest ones, submedial, placed on or just below the fork of the veins, exindusiate, with distally flexuous paraphyses 200–395 μ m long; sporangia c. 200 μ m long, on a very short stalk. Mature spores not seen. **Fig. 1.**

Specimens examined: Queensland. COOK DISTRICT: Maloney's Springs, Hann Creek, 12°28'S, 142°56'E, Jul 1988, Forster *et al.* 4525 (BRI,NSW,CANB, to be distributed); cultivated plant, collected Jul 1988, sampled Mar 1990, Kenning s.n. (BRI, in spirit only).

Distribution and habitat: This rare treefern is known at present from only one population of a few dozen individuals at the type locality, at an altitude of c. 150 m, on northern Cape York Peninsula; the habitat is dense notophyll palm vinehicket (Webb 1978), a type of closed forest scattered along the eastern coast and adjacent hinterland of Cape York Peninsula. Movement within the forest is difficult and often unpleasant because of the very high density of *Calamus* and *Freycinetia* stems. Plants of *Cyathea exilis* grow on rocks or hummocks in swampy conditions on the floor of the basin carved from the surrounding sandstone plateau. The humidity is high even in the dry season (June to December or January). Associated ferns include *Cyathea rebecca*, *C. felina*, *Angiopteris evecta* and *Taenitis blechnoides*.

Conservation status: The suggested code is 2E (Briggs & Leigh 1988), in view of the small population and very restricted distribution. The vineforest at the type locality covers an estimated area of 80–100 hectares.

Notes: In his discussion accompanying the type description, Holttum quotes Jones' suggestion that the fern is a rheophyte. I would rather describe it as a 'hydrophyte', to avoid the implication of dependence on running water that the former term invokes.

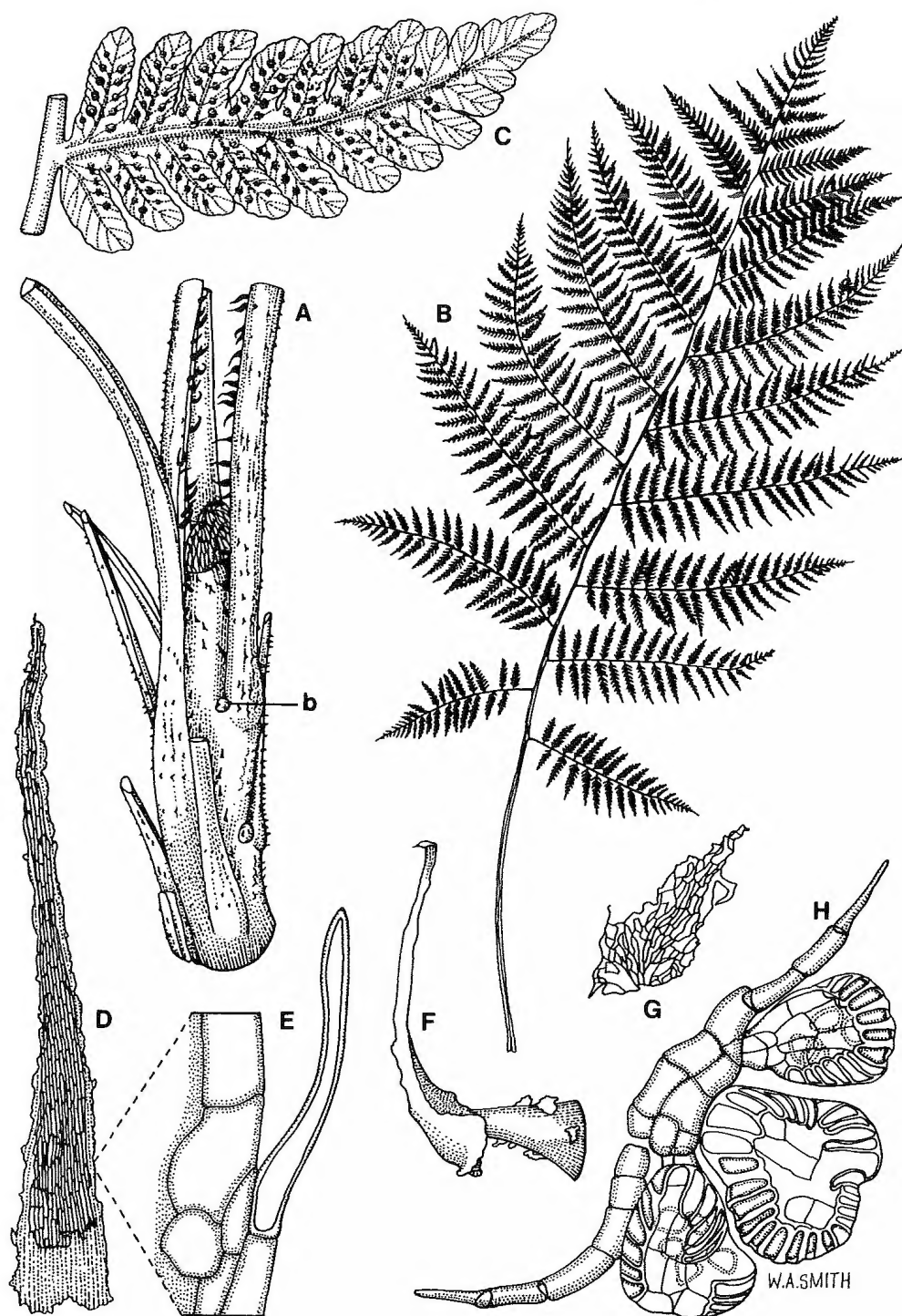


Fig. 1. *Cyathea exilis*: A. apex of caudex and stipe bases $\times 0.67$. B. frond $\times 0.17$. C. pinnule $\times 2$. D. stipe scale (surface view) $\times 12$. E. margin of stipe scale $\times 325$. F. spinule from stipe with attached scale (oriented as in life) $\times 12$. G. bullate scale from abaxial pinnule surface $\times 25$. H. sporangia and paraphyses $\times 130$. A, Kenning s.n. (from living plant); B, Forster *et al.* 4525 (drawn from pressed frond); C–H, Kenning s.n. (in spirit). B–H at BRI. (b – proliferous bud).

The habit of *C. exilis* reflects that of lowland populations of *Dicksonia youngiae* in southern Queensland, in growing in drainage basins under rainforest, but rarely with water lapping the trunk except during seasonal flooding. Constant humidity appears to be more of a controlling factor than the presence of running water.

The similarity of *C. exilis* with *D. youngiae* extends to the proliferous buds along the trunk, which can develop small fronds while on the living trunk, although it is more usual for a cluster of trunks to be produced at ground level around a living or dead parent trunk, or a line of new plants to develop along a fallen trunk. Broken or damaged trunks exhibiting this vegetative regeneration are relatively common in the field (Forster and Kenning, pers. comm.).

C. exilis is very closely related to *C. macgillivrayi* (Bak.) Domin of Papua New Guinea and Irian Jaya; indeed, apart from the longer paraphyses in the sori, and a less distinct pinnule dimorphism, *C. exilis* is to all intents identical to *C. macgillivrayi*. My examination of BRI specimens of *C. macgillivrayi* and an isotype specimen of *C. gracillima* Copel. (placed in the synonymy of *C. macgillivrayi* by Holttum, 1963) did not reveal any other significant morphological differences.

As regards the habitat requirements of *C. macgillivrayi*, most collections of it were from ridges on mainland New Guinea, as Holttum states, but at least one of the collection sites of *C. gracillima*, south-west of the Idenberg River, Irian Jaya, was described as 'a mountain-locked valley, swampy in places and drained by a considerable stream...' (Brass 1941). The specimen Brass 13489, from this locality, is recorded as 'plentiful on river flats' (Copeland 1947). The island collections of *C. macgillivrayi* (Lousiade Archipelago) are mostly from below 300 m altitude (Holttum 1963). Mainland New Guinea is not much closer to the Lousiade islands than to the site of *C. exilis* on Cape York Peninsula.

In spite of my comments above, I am disinclined to place *C. exilis* in synonymy with *C. macgillivrayi* at present. Living or spirit-preserved material, particularly of *C. macgillivrayi*, is essential to allow accurate comparisons of their morphology.

The illustration of the sporangia and paraphyses of *C. exilis* was made from alcohol-preserved pinnule fragments, bearing more or less mature sori (before any dehiscence had occurred); these fragments were mounted whole in Hoyer's medium.

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CORRIGENDUM**Austrobaileya 3(2) 1990****p. 186. line 34. Correct spelling to *Aeschynomene micranthos*.**

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